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ABSTRACT

This guide is intended to assist industrial arts teachers, school administrators, and architects in planning and designing functional facilities for instructional purposes or in remodeling existing facilities. It was developed under the auspices of the Council for Industrial Arts Education and published by the Missouri State Department of Education. The contents include detailed information on: (1) Educational Planning, Specifications and Definitions, (2) General Considerations, (3) Program and Space Needs, and (4) Equipment and Furniture. Design criteria, a planning check list, a planning reference chart and a bibliography are given in the appendixes. The document is illustrated with photographs. (GR)

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PLANNING AND EQUIPPING INDUSTRIAL ARTS INSTRUCTIONAL FACILITIES

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FOREWORD

This guide was organized under the auspices of the Council for Industrial Arts Education and published by the Missouri State Department of Education. In preparing this publication, the supervisory personnel in the State Department and the Production Committee were dedicated to the task of positively influencing the planning and constructing of industrial arts instructional facilities in the public schools of Missouri.

This guide is intended principally to assist industrial arts teachers, school administrators and architects in planning and designing functional facilities for instructional purposes. It will also provide assistance in remodeling existing facilities. Industrial arts teacher educators will likewise find the guide helpful in preparing teachers for the profession.

A critical review of the publication will indicate that the Production Committee thoroughly studied available materials concerning the subject. The pictures display many useful ideas gathered from various facilities throughout the state.

The members of the Production Committee are to be commended for their willingness to give of their time and professional skill in the development of this guide. This endeavor is definitely a positive contribution to the profession.

Hubert Wheeler

HUBERT WHEELER
Commissioner of Education

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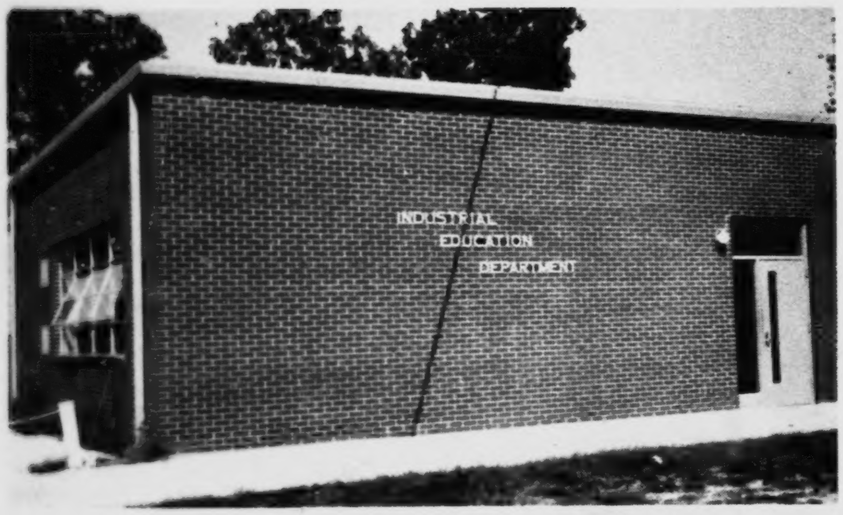
PART I

EDUCATIONAL PLANNING, SPECIFICATIONS AND DEFINITIONS

- Introduction
- Educational Planning
- Educational Specifications
- Definitions
  - Types of Facilities
  - Levels
  - Instructional Areas and Courses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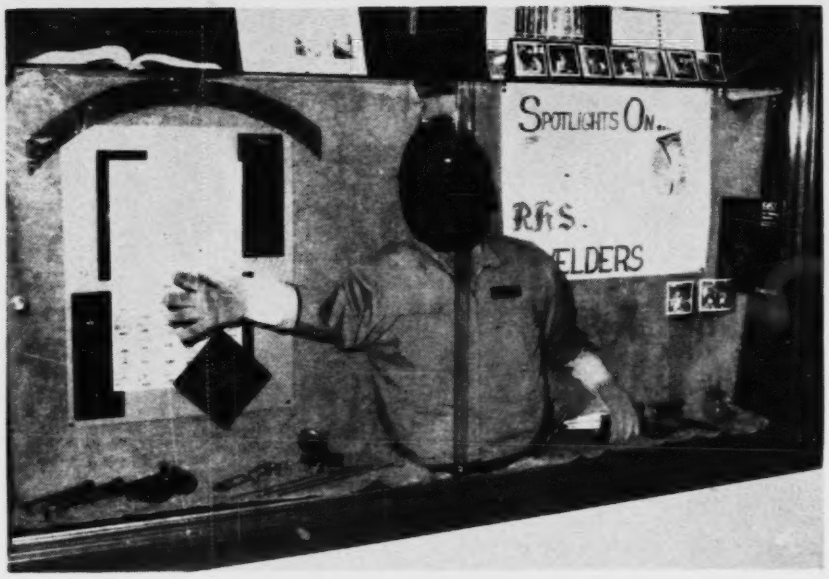
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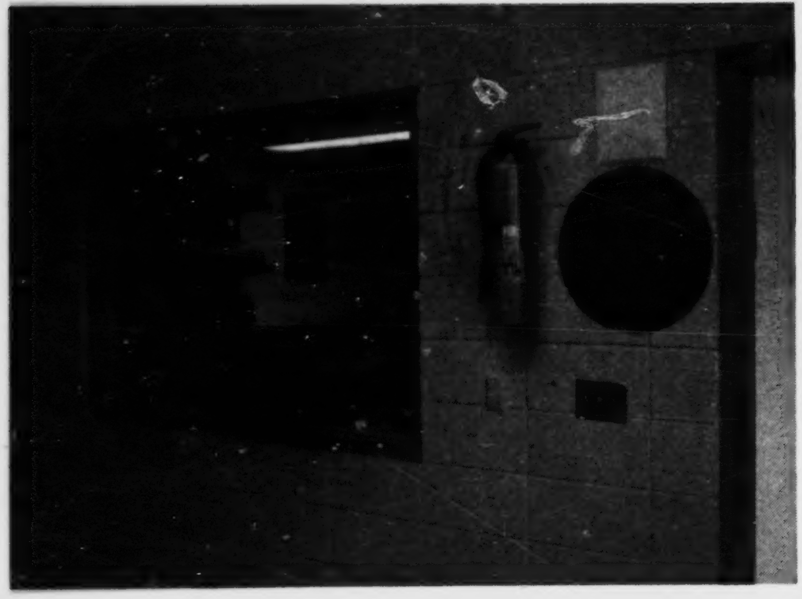


PART I

EDUCATIONAL PLANNING, SPECIFICATIONS AND DEFINITIONS

INTRODUCTION

The purpose of this publication is to provide general guidelines for educators and architects, in planning facilities necessary for the instructional program of industrial arts. The information is not intended to provide specifications for any one kind of facility but to offer basic suggestions pertinent to the planning of any school industrial arts laboratory. These guidelines should assist local officials in making decisions that will result in facilities that permit the achievement of program objectives in an efficient and effective manner. The industrial arts instructor, with assistance of professional consultants in the field of industrial arts, is the best qualified person in the local community to outline the industrial arts curriculum and the learning activities which suggest the facilities required to house the program. The industrial arts teacher, in turn, needs to work directly with the superintendent, or his designated representative in the total school planning program.

Before facility planning can begin, the philosophy of industrial arts must be clearly specified, communicated, and understood by the instructor, the school administrator, and the board of education. This philosophy will determine the program objectives, which in turn establishes the framework for curriculum and student learning activities.

EDUCATIONAL PLANNING

Educational planning is the process by which those in positions of educational leadership assemble facts and resources pertinent to the total educational enterprise as well as obtain information regarding the nature and needs of the community.

The most important step in the entire process of planning a school plant or addition to an existing one is the determination of the character of the educational program which is to be housed.

Those involved in the planning process should systematically identify and evaluate basic educational needs. This is the most important activity in the overall planning process, and it should precede all other activity. This can be accomplished first through a self-evaluation and later be expanded by an educational survey that would result in a thorough and objective appraisal of the educational program and facilities. Assistance from specialists and consultants from outside the district is usually found to be very beneficial.

Throughout the entire planning process, a clear understanding of the functions and responsibilities is essential for all participants including advisory committees, the school staff, consultants, architects and engineers, as well as the board of education. Participants must have assurance that their proposals will be respected and given serious consideration by the policy-making body.

The highest order of educational leadership is needed on the part of the superintendent, often with a competent consultant to advise and assist him.

Finally, there must be mutual respect and confidence, a frank sharing of concerns and ideas, and a penetrating appraisal by the group of all ideas advanced.

EDUCATIONAL SPECIFICATIONS

Written educational specifications clearly state all decisions growing out of the educational planning process. They should provide the architect with all of the essential information which he must have to understand the architectural problem to be solved and the various limitations under which he must work.

Educational specifications must be defined as an effective means of communication between educators and architectural designers. They are the communicative media through which the educators identify the educational program and factors which affect teaching and learning, thus providing a basis for the architect's development of building plans and specifications. In addition to written educational specifications, discussions and visits to existing facilities may greatly aid in communication and understanding.

Educational specifications should provide a sound basis for architectural planning and the development of functional building plans and specifications.

Much of the information can be presented in straightforward written composition; however, other information is best expressed and presented in diagram or tabular format. Specifications should be prepared in simple language so that they may be rapidly interpreted by the architect and others. Good educational specifications for the industrial arts department should reflect:

1. Philosophy and objectives of the community and school.
2. Number of pupils to be taught in each class or department.
3. Educational program, including curricular offerings and activities of pupils and teachers.
4. Discernible trends in programs, facilities, and space.
5. Space needs including kind, number and approximate size of each instructional or auxiliary area in terms of the program and learning activities involved.
6. Spatial relationships or coordination desired within various parts of the school plant to insure satisfactory functioning of the building.
7. Material, equipment and furniture needs.
8. Facilities and services needed such as audio-visual aids, adequate light, heat, ventilation, air conditioning, aesthetic and acoustical treatment including floor covering, color and decorations.

Well prepared educational specifications are an instrument of good planning and design and, if used effectively, should result in functional facilities which can promote the desired educational program.

DEFINITIONS

Laboratory (shop). A room or rooms appropriately equipped for various areas of industrial arts instruction. This facility will be used by the students and instructors for planning, investigating, testing, conferring, demonstrating, and teaching with visual as well as auditory methods. The manipulation of tools and other equipment along with the evaluation of pupil development will likewise be important activities conducted in the facility. The term laboratory will be used throughout this guide.

The following terms with their definitions are as they appear in the Handbook for Industrial Arts Education—1969 published by the Missouri State Department of Education. Types of Facilities on page 3-14, Levels on pages 2-3, 2-4 and Instructional Areas and Courses on pages 6-1 to 6-6.

TYPES OF FACILITIES

Comprehensive General Laboratory. This facility is a self-contained laboratory in which provision is made for instruction in all of the major areas of industrial arts education.

Multi-Area Laboratory. This facility provides for instruction in more than one of the major instructional content areas in industrial arts education. For example, the study of metals and electricity may be accomplished in a multi-area laboratory.

Area Laboratory. This facility provides for the instruction in several phases of one particular area of study. For example, the study of metal materials and a variety of the associated machine and tool processes might be accomplished in an area laboratory for metals.

Unit Laboratory. This facility provides for instruction in one content area. For example, welding might be taught in a unit laboratory specifically designed for that particular unit of the metals area.

LEVELS

Level I. Exploratory industrial arts (general shop) should be required in the middle and/or junior high school. The course is exploratory in nature and provides an opportunity for students to become oriented to a number of content areas in industrial arts. Since emphasis is placed on breadth of experiences rather than depth, experiences should be provided in as many basic technical areas as possible.

If content is organized according to industrial materials, all students should experience at least four different content areas during each of two years. If the school enrollment justifies only one industrial arts facility, it would be necessary to equip the facility with the tools and equipment essential to conduct an exploratory program in all content areas. However, schools with larger enrollment might find it more efficient to have separate facilities for two or three of the more closely related content areas.

Level II. While the content and experiences at Level I are designed as general education that provide common learnings desirable for all, Level II courses are designed as elective education beginning at the ninth grade and are built upon the exploratory experiences provided at Level I. The Level II courses promote unique interests, needs, and abilities of individuals rather than those common to all.

Courses at Level II are intermediate in nature offering one or two semesters of study in a single industrial arts content area. Courses in each content area may be included in the industrial arts curriculum at Level II, and students should be encouraged to elect more than one course at this level before proceeding to a Level III course.

Level III. **Level III courses are advanced technical courses designed to provide experiences in a rather specialized phase of a single content area of industrial arts and must be preceded by a Level II course in the same content area. This level is not to be merely an extension or continuation of competencies developed in Level II, but in addition, it should provide an opportunity for the study of new phases related to the content experienced at Level II. For example, Level II metals should include many facets of metals, i.e., sheet metal, welding, forging, foundry, basic machining, and fundamental properties of metals. In contrast, Level III might be an in-depth study of welding, including such forms of welding as, electric arc, oxyacetylene, resistance and gas shielded arc (Tungsten Inert Gas and Metallic-Inert Gas). A study of metals technology might also be a Level III offering including such content as heat treating, testing, characteristics and strengths of metals, special alloys and their properties, etc.**

Although these courses are quite specialized, their primary purpose is to meet the more unique interest and needs of the individual and not to prepare him for a specific occupation.

Level IV. **Recognizing that the role of industrial arts at this level is to meet the specialized needs of youth, it is not logical to expect that a standardized program could be proposed that would be equally effective in all senior high schools. The strength of industrial arts offerings at this level is its diversity and its adaptability to new conditions and new circumstances. Decisions regarding specific content organization, methodology, as well as the nature of the learning activities are dependent upon the needs, abilities, and interests that characterize a given group of students to be served. The following suggestions are typical of those that may be considered after a study of the needs, interests, and abilities of students in a given school has been made.**

*** A specialized course which would deal primarily with research and experimental processes could be established for students who are seeking greater understanding and application of the principles and concepts of the physical sciences and mathematics.**

While the nature of an industrial arts program is such that a great deal of individual and small group instruction is undertaken, the distinct and separate needs of both the slow and rapid learner are less likely to be met in classes where the range of ability is too broad. Separate classes for the slow and rapid learners are desirable to supplement the basic program in a school.

*** Cooperative experiences can be designed between industrial arts and other subjects such as; mathematics, science, and art to provide opportunities to apply knowledge gained through these other courses.**

*** Another type of class for technical instruction, but not restricted to the gifted student, could be designed for those preparing for future careers in a technologically oriented area such as engineering.**

*** Many students with semi-skilled occupational intersts are deprived of an opportunity for specific training due to the lack of appropriate programs. A specialized course might be organized that would give a greater amount of attention to skill development and work orientation than the typical industrial arts courses given.**

*** Courses designed especially to contribute to the development of leisure time interests of youth and adults may be organized.**

TERMS FOR INSTRUCTIONAL AREAS AND COURSES

Industrial Crafts Area — A category of information and skills concerned with handcrafts and the craft industry, including the tools, materials, processes, projects, and occupations of the industry. Subject matter and learning experiences are organized under various descriptive categories such as art metals, ceramics, crafts (industrial), industrial crafts, leather, textiles, and other crafts (industrial).

Art Metals — The study of metals which are used in the manufacture or fabrication of ornamental products. Learning experiences generally include experimenting, designing, constructing, and evaluating art metal products.

Ceramics — The study of the tools, materials, and industrial processes involved in the manufacture of products made from nonmetallic resources such as rocks, clay, glass, and sand and the various types and uses of ceramic products. Learning experiences generally include experimenting, designing, constructing and evaluating ceramic products.

Crafts (Industrial) — The study of craft industries including the tools, and processes used to produce craft products from a wide variety of materials such as ceramics, leather, rocks, fibers, metals, and woods. Learning experiences generally include experimenting, designing, constructing, and evaluating useful products with emphasis on industrial applications.

Leather — The study of leather and related materials including the tools and processes used to produce leather products. Learning experiences generally include experimenting, designing, constructing, and evaluating products.

Drafting Area — A category of information and skills concerned with conveying ideas or illustrations graphically through drawings, charts, sketches, maps, and graphs and the related factors such as the role of drafting in history and industry. Subject matter and learning experiences are organized under various descriptive categories such as architectural drafting, descriptive geometry, drafting, drafting technology, engineering, drawing, industrial design, mechanical drawing, technical illustration, and other drafting.

Architectural Drafting — The study of the means of communicating, through lines and symbols, information about buildings. Learning activities include the development of preliminary sketches, plans, elevations, sections, and detail drawings and the study of architectural design, the history of structures, building ordinances, and building materials.

Descriptive Geometry — The study of the representation of points, lines, and surfaces by accurate orthographic drawing and the graphical solution of problems according to form and position in space.

Drafting — The study of the communication of ideas through drawings, sketches, charts, graphs, and maps. Learning experiences include the development of skills through the use of drafting instruments involved in lettering, sketching, geometric construction, orthographic and pictorial drawing, auxiliaries, sections, and working drawings.

Drafting Technology — The study of graphic representation with special emphasis placed on technical requirements, specifications, and standards.

Engineering Drawing — A study of the communication of ideas through lines, symbols, and drawings depicting the mechanical details associated with machine parts, including machine design. Learning activities involve the use of technical drawing instruments and techniques.

Industrial Design — The study of industrial products with special consideration being given to (1) aesthetics and the appropriate use of industrial materials and processes, and (2) their value to society. Learning activities involve the development of skills and creative abilities in the use of media for conveying ideas graphically.

Mechanical Drawing — A study of the communication of ideas through lines, symbols, and drawings. Learning activities involve the use of technical drawing instruments to convey ideas graphically, e.g., orthographic projection, pictorial views, and assembly drawings.

Technical Illustration — The study of the techniques of presenting information graphically including schematics, sections, exploded view, and others which illustrate or clarify verbal or written description.

Electricity/Electronics Area — A category of information and skill concerned with electrical energy including theory, applications, and control related to electrically powered equipment and to various kinds of communications equipment and related factors such as occupations, economics, and consumer information. Subject matter and learning experiences are organized under various descriptive categories such as electricity, electricity/electronics, electronics, and other electricity/electronics.

Electricity — The study of sources, measurement, control, and applications of electrical energy such as those used for heating, power, and illumination, as well as some elementary aspects of the use of electrical energy for communication as in devices such as the telegraph, telephone, and radio. Learning activities include demonstration of, experimenting with, designing, constructing, and testing electrical devices.

Electricity/Electronics — The study of sources, measurement, control, and applications of electrical energy in devices such as those used in heating, power, and illumination, as well as those used in communications such as the telegraph, telephone, radio, television, radar, and computers. Learning activities include demonstration of, experimenting with, designing, constructing, and testing electrical devices.

Electronics — The study of the measurement, control, and applications of electrical energy in devices used for communication such as the telegraph, telephone, radio, television, radar, and computers. Learning activities include demonstration of, experimenting with, designing, constructing, and testing electrical devices.

Graphic Arts Area — A category of skills concerned with graphic reproduction are studied as well as related factors such as occupations, economics, and consumer information. Subject matter and learning experiences are organized under various descriptive categories such as graphic arts, photography, photolithography (offset), printing, and other graphic arts.

Graphic Arts — The study of tools, materials, and processes of the printing industry involving block printing, intaglio printing, letterpress printing, lithography, photography, rubber stamp construction, silk screen printing, thermography, type composition, and binding. Learning experiences include designing, composing, printing, and evaluating reproduction techniques, and the study of history, economics, occupations, and consumer information of the printing industry.

Photography — The study of the tools, materials, and processes used in photography with emphasis on industrial uses. Learning activities include experiences using cameras, developing negatives, and making contact prints, enlargements, and mountings.

Photolithography — (Photo Offset Lithography or Offset) — The study of the technology of graphic reproduction from a flat surface or plate prepared photo-mechanically. Learning experiences include design, hot and/or cold composition, paste-up, camera and dark room techniques, platemaking, and offset presswork.

Printing — The study of the industry and technology involved in graphic reproduction from an inked surface, either relief, intaglio, or flat. Activities include design, composition, imposition, press work, and bindery.

Manufacturing — The study of the technology and the socioeconomic contributions of those industries concerned with the creation of durable consumer products. Learning experiences are developed around functions or concepts of industry and include research and experimentation, product design and development, fabrication (custom and mass), packaging, and distribution.

Industrial Materials and Processes Area — A category of information and skills concerned with industrial-technical materials and processes including their properties and utilization as they are fabricated into usable products. Subject matter and learning experiences are organized under various descriptive categories such as fluid power, industrial materials, industrial materials and processes, industrial processes, instrumentation, numerical control, and other industrial materials and processes.

Industrial Materials — The study, analysis, and testing of industrial materials, e.g., metals, hydrocarbons, wood, finishes, plastics, and earth materials, chemical composition, physical and mechanical properties, fabrication limitations, and performance when exposed to a normal industrial and commercial environment.

Industrial Materials and Processes — The study of the properties and utilization of industrial materials as they are fabricated into usable products, including a study of the utilization and control of the power necessary to efficiently process materials.

Industrial Processes — The study of the methods whereby industrial materials are fabricated by hand, machine, and automated equipment to produce usable products.

Instrumentation — The study of devices necessary to observe and control both manufacturing processes and the performance of mechanical and electrical machinery, including the science of measurement as well as the conversion and recording of physical, chemical, and mechanical state and condition into sensible information.

Numerical Control — The study of industrial automation in which specific commands to perform desired machine tool operations are supplied to the machine control mechanisms by means of information previously programed by punched tape, or magnetic tape.

Metals Area — A category of information and skills concerned with metals including the products manufactured from metals; the technology employed in the production, processing, and use of metals; and related factors such as occupations, economics, and consumer information. Subject matter and learning experiences are organized under various descriptive categories such as metals, metal machining (metal shop), metal technology, sheet metal, welding, and other metals.

Metals — The study of the tools, materials, and processes used in several facets of the metals industries. Learning experiences generally include experimenting, designing, fabricating, forming, and evaluating metals and metal products.

Metal Machining (Metal Shop) — The study of the operations and related information concerned with the shaping of metals by machine.

Metal Technology — The study of the problems and operations involved in the transformation of metal into usable products with special emphasis placed on technical information, qualities, specifications, and standards. Learning experiences include experimenting, creating, designing, constructing, and evaluating metal products.

Sheet Metal — The study of the operations, problems, and related information concerned with forming and fabricating sheet metal products.

Welding — The study of the operations used in cutting and fabricating metal products by welding techniques.

Plastics Area — A category of information and skills concerned with the production, processing, and uses of plastics and related factors such as occupations, economics, and consumer information. Subject matter and learning experiences are organized under various descriptions such as plastics, plastics technology, and other plastics.

Plastics — The study of the tools, materials, and processes used in several facets of the plastics industry. Learning experiences include experimenting, designing, machining, fabricating, forming, and evaluating plastics and plastic products.

Plastics Technology — The study of the problems and operations involved in the manufacture and transformation of plastics into usable products with special emphasis placed on technical information, qualities, specifications, and standards. Learning experiences include experimenting, creating, designing, fabricating, forming, and evaluating plastic products.

Power and Automotive Area — A category of information and skills concerned with the various forms of power including its generation, transmission, and utilization. Subject matter and learning experiences are organized under various descriptive categories such as automotive mechanics, power and automotive mechanics, power mechanics, transportation, and other power and automotive mechanics.

Fluid Power — A study of hydraulics and pneumatics, including power conversion, transmission, and utilization in both stationary and mobile installations.

Power and Automotive Mechanics — The study of the technology involved in harnessing and controlling power, including its source, generation, transmission, and utilization, with specific emphasis upon the automobile as a device of power conversion, transmission, and utilization.

Power Mechanics — The study of the development, transmission, and utilization of power, including the theory, maintenance, and servicing of machines and devices for the conversion of power into useful forms. Methods and devices for the transmission of power and output machinery for utilizing power are emphasized.

Transportation — The study of operating principles, design, construction, maintenance, and repair of transportation devices, e.g., automobiles, airplanes, trains, and boats, including an understanding of related physical and chemical principles.

Woods Area — A category of information and skills concerned with woods, including various manufactured products, the technology employed in the manufacture and construction of products using woods, and related factors such as occupations, economics, and consumer information. Subject matter and learning experiences are organized under various descriptive categories such as woods, wood technology, and other woods.

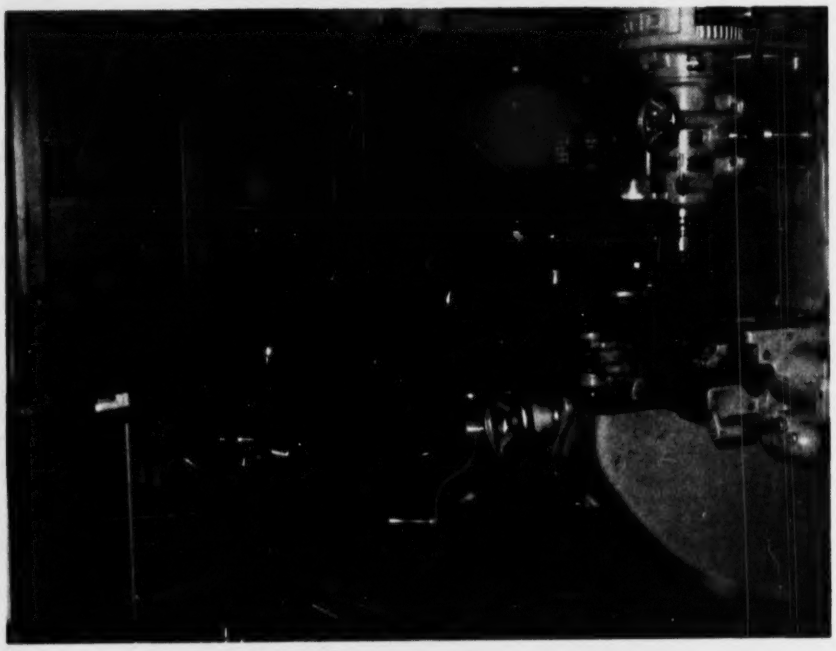
Woods — The study of the tools, materials, and processes used in the woods industries. Learning experiences generally include experimenting, designing, constructing, of wood products and evaluating woods and wood products, using the tools, materials, and processes related to woods industries. The study of such factors as the techniques, economics, and consumer information of the industry are emphasized.

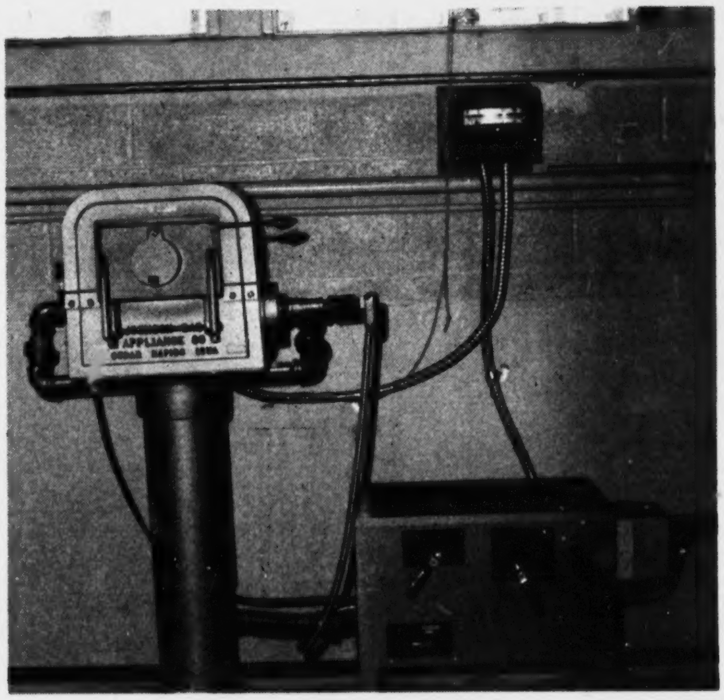
Woods Technology — A study of the woods manufacturing industries and the technology involved in the construction of buildings and the manufacture of articles made from wood and wood products. Learning experiences include experimenting, designing, constructing, operating and evaluating industrial tools, processes, forest products, and related synthetic materials.

PART II

GENERAL CONSIDERATIONS

Location
Flexibility
Sound
Safety and Health
Color and Finishes
Temperature Controls, Ventilation and Exhausts
Lighting and Electrical Power
Utilities
Other Considerations

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PART II

GENERAL CONSIDERATIONS

Industrial arts education provides experiences through which the student may acquire skills, knowledges, and appreciations concerning our present day industrial society. As a school subject, it is a study of the materials, tools, processes, organizations and human problems of industry. To satisfy the need, it is necessary to have a well conceived and properly planned industrial arts facility that will provide the basis for the dynamic and stimulating industrial arts curriculum. Along with this, attention has to be given to the contribution which industrial arts makes in the total education of youth. Therefore, this facility is an integral part of the total school plan.

Industrial arts facility planners are confronted with complicated problems in planning facilities. Items of concern which are included in this section of the planning guide deal with location, flexibility, sound control, color dynamics, ventilation, lighting, heating and cooling, and other basic needs.

LOCATION

Industrial arts laboratories should be located in a wing of the main building or in an adjacent building with covered walkways. When possible, laboratories should be placed on the ground floor with an outside entrance to a parking lot or service drive. This entrance should be with a double or overhead door.

Future growth and expandability should be given consideration when designing the instructional facilities. Some other features that deserve consideration are as follows:

A. North lighting for drafting rooms is most desirable

B. Laboratories need windows on one side only

C. One main entrance or exit to main hall or corridor for each laboratory

D. A double door with removable mullion is recommended for each laboratory

E. All auxiliary rooms should have openings directly into the laboratories

F. Toilet facilities, for both boys and girls, should be within 100 feet when not included in the laboratory itself

G. Convenient outside accessibility is necessary to accommodate adult education groups during non-regular school hours

H. Accessibility from a service drive for delivery of supplies and equipment

I. Proximity to those interrelated areas such as: science, art, home economics, and vocational-technical instructional areas

FLEXIBILITY

In this time of change, laboratories must be built with flexibility and expandability expressly in mind. Due to the mobility of our population, enrollment in some schools may change rather rapidly. The experimenting with and changing of instructional approaches will likewise require the utmost of flexibility in facilities. Among the items that will warrant consideration to assure flexibility are:

A. Partitions between laboratories should be non-bearing walls that are as free as possible of heating and plumbing installations.

B. Overhead buss bar type electrical system provides for a great deal of flexibility in relocating machinery and equipment.

No doubt there are other items that deserve consideration that will add to the flexibility of functional facilities.

SOUND

Due to the nature of the industrial arts program, many noise-producing activities are carried on in the industrial arts department. These noises may be distracting to persons both in the department itself as well as in other areas nearby. Therefore, noise treatment must be provided. In giving special attention to sound control the following items may deserve consideration:

A. When several laboratories are built in a cluster, the noisier areas may be separated from the quieter areas by storage rooms and offices

B. An enclosed planning area separate from the laboratory itself

C. Utilization of noise absorption materials such as acoustical materials for ceilings, walls, and floors

D. Mounting of machines and equipment on rubber or composition pads. Avoid mounting on columns or other structural members of the building

It has been shown experimentally that there is an increase of nearly 1/5 in the amount of energy expended when working in a noisy environment as compared with a quiet environment. This in itself indicates the need for giving sound control serious consideration when planning instructional facilities. Because this is a highly technical area, help from a specialist in the field of acoustics should be secured.

SAFETY AND HEALTH

Including the many necessary safety features for adequate and safe instructional facilities is almost an endless task. Although it is an extensive chore, it is one that deserves utmost thought and consideration. Recognizing that safety education is laced through all areas of the industrial arts curriculum, emphasizes the need for incorporating as many built-in safety features as possible.

Protection from hazards such as: gases, fumes and dust; electrical arc and shock; moving machine parts; and slippery floor surfaces are to mention just a few. More specific items due consideration may include:

A. A master disconnect switch for the entire power system in each laboratory

B. All machinery and equipment being properly guarded and shielded

C. Safety-pilot systems for all kilns, furnaces and ovens

D. Safety zones marked around each machine with non-skid areas for operator's station

E. Properly grounded power machines with adequate overload disconnect apparatus

F. A properly grounded (3 wire) 110-120 volt electrical system

G. Light fixtures, switches and electrical devices located in finishing or paint rooms must be explosion proof type

H. Properly installed and adequate ventilation system for the entire area

I. Adequate exhaust systems for areas with fumes, gases, and dust

J. Sufficient number of appropriately located and proper type fire extinguishers

K. Adequate and satisfactory lighting

Consultation with the local fire chief is advisable to insure meeting the local fire and safety code. For the safety check list provided in this guide, refer to Appendix B, page 5-5.

For more specific information regarding safety in school shops and laboratories refer to "An Accident Prevention Program for School Shops and Laboratories — A Suggested Guide for Administrators" listed in Appendix D, page 5-12.

COLOR AND FINISHES

Appropriate colors in the facilities make for more pleasant learning and working conditions. They also aid in the safety program as well as having a great influence on the lighting situation.

Color can destroy or reaffirm the beauty of a building, its utility, its proportion, and its overall space. Furthermore, its phychological effect on pupils must be considered. For example, greens, aquamarines, and blues appear to be restful, while reds are stimulating, yellows exhilarating, and some browns and grays depressing. Northern rooms may be benefited by warm colors; warm exposures, by cool colors.

Attention should be given to surface finishes on walls, woodwork, furniture, and equipment.

Furniture of a neutral color with a nonglare finish is most desirable. Glossy surfaces should be eliminated in order to avoid disturbing glares and highlights.

The frames of machines and equipment should be of neutral shades (gray or green) often times with the immediate work area being highlighted with a color that better reflects the light for increased visibility. The use of bright focal colors on controls and danger points on equipment and machines provides a safer environment, as well as an attractive appearance.

The following safety color code has been suggested by the American Standard Association.

Red —	Used to identify fire protection equipment. Area around or behind such equipment is painted in a red square.
Orange —	Used to designate dangerous parts of machines such as guards, cutting edges, gear boxes, open belts, etc.
Yellow —	Used on construction equipment, coverings or guards on hazardous equipment, ceiling-suspended units, and inside covers of switch and fuse boxes. Yellow, striped with black, is used on handling equipment, traveling conveyors, and low beams in operating areas.
Green —	The basic color for safety units and first-aid equipment. Used on stretchers, first-aid kits, gas masks, safety bulletin boards, etc.
Blue —	Indicates precaution and is used to mark equipment controls, electrical controls, valves, brakes, kilns, etc.
White —	The sanitation color. Used on refuse cans, fountains, and food-dispensing equipment. Also used in corners of dark passageways, stairways, etc.
Purple —	Warns against radiation hazards. It is used on doors leading to dangerous areas and on receptacles for radioactive materials.

TEMPERATURE CONTROLS, VENTILATION, AND EXHAUSTS

Maintaining the proper thermal environment is an important factor in assuring a satisfactory teaching-learning environment. The condition of the air and the surface temperature in the instructional area affects the physical and mental comfort of pupils, therefore, influencing their learning and working efficiency. A carefully controlled atmostphere in laboratories and classrooms reduces excessive stress, strain and fatigue on pupils and teachers alike.

A ventilation system should provide fresh air constantly, especially in small or close spaces such as; the planning areas, teacher's office, dark room and finish room. Air conditioning will be a major benefit with the increase in the utilization of school facilities during the summer months. Many teachers who already have air conditioned facilities indicate that the air is cleaner and less humid, resulting in reduced equipment maintenance and replacement cost.

The following related items are among those that merit consideration in this area when planning instructional facilities for this type of program:

A. The room temperature should be thermostatically controlled

B. Finishing rooms should have separate ventilating systems with exhausts that flow directly to the outside

C. Dust collection equipment for grinders, planers, jointers, saws, sanders, etc.

D. Hooded exhaust systems for hot metal areas

E. Exhaust hookups for power mechanics laboratories

F. Spray booth for each finishing room

G. An adequate exhaust system for the welding area

LIGHTING AND ELECTRICAL POWER

LIGHTING

Lighting for the instructional facilities may be divided into two categories, natural and artificial. The natural light may enter through windows or sky domes. North and east light should be planned wherever possible, although care should be exercised to avoid glare from these natural sources. Artificial lighting systems should provide a uniform distribution of shadow-free, glare-free illumination that conforms to adopted standards.

General artificial lighting should be provided by indirect or semi-indirect fixtures, the latter provided with ballasts have a low noise level. Local power companies and/or a qualified architect should be consulted for recommendations regarding correct type and number of fixtures to be used.

A General Lighting Chart, Figure I, page 2-6 provides minimum recommendations regarding the various instructional areas. The following items are among those that require consideration when planning a lighting system for industrial arts facilities:

A. Fluorescent type fixtures are most often used in drafting rooms. Diagonal mounting helps eliminate shadows.

Note — Interference filters will be necessary when fluorescent lighting is utilized in the instructional areas utilizing radio and television.

B. Auxiliary lights may be needed on individual machines where concentrated light is necessary.

C. The influence of color selection on the lighting situation.

D. Lighting and fixtures for the finishing room, darkroom, and display areas should meet the special needs of these areas.

E. Darkening shades or drapes for windows in areas planned for the utilization of visual projectionals.

FIGURE I
GENERAL LIGHTING CHART

Recommended Foot Candles of General Illumination at Work Surfaces

Instructional Areas	Rooms						
	Laboratory or Shop	Classroom or Planning Area	Instructor's Office	Material Storageroom	Project Storageroom	Finishing Room	Dark Room
DRAFTING	150	150	30	20	20		
ELECTRICITY/ ELECTRONICS	100	100	30	20	20		
GRAPHIC ARTS	150	30	30	20	20		*
INDUSTRIAL CERAMICS	100	30	30	20	20	100	
INDUSTRIAL CRAFTS	100	30	30	20	20	100	
INDUSTRIAL PLASTICS	100	30	30	20	20		
METALS	100	30	30	20	20	100	
POWER MECHANICS	100	30	30	20	20		
WOOD	100	30	30	20	20	100	

***Special darkroom lights required.**

General lighting frequently needs to be supplemented by specific lighting.

ELECTRICAL POWER

The electrical requirements for the power equipment are of vital concern in planning new instructional facilities or revamping existing facilities. Designers of the electrical system for industrial arts departments must make certain that circuits and outlets are adequate in number, kind, and capacity to meet present, as well as future needs of the various laboratories for power machines and lighting in the various laboratories. Centralized boxes or panels utilizing individual circuit breakers and lock-latch doors are highly desirable in every laboratory. A keyed reset switch for panic buttons which are strategically located in the laboratory should also be provided at the master control panel. Sufficient outlets along the walls where power equipment may be located or used are necessary for flexibility; however, tool or cabinet storage and displays should be considered in placing the outlets. Self-retracting drop outlets over benches for portable equipment are desirable.

An overhead buss bar system or an overhead perimeter conduit system may be designed for equipment located throughout the shop. Under floor troughs may also be considered for the electrical power system. In this case, floor type outlets must be covered and flush with the floor. Services should be planned for instructional media, such as; overhead and other projectors, recorders, and closed-circuit television; for clocks, signalling, telephone, and other communications devices; and in the electricity/electronics laboratory, for central and/or individual power supplies. Special attention, such as a red "bulls-eye" jewel indicator to control switch, should be given to electrical service for welders, kilns, electric furnaces, and other equipment with high amperage ratings.

Among the other items that deserve consideration are:

A. 110/120 volts grounded double wall outlets, located 36-42 inches above the floor and spaced 10-15 feet apart, should be installed along the walls as well as in columns throughout the areas.

B. For maximum safety, each power machine should be equipped with a magnetic overload switch that is operated with a pushbutton.

C. Each power machine must have a positive ground.

D. Single-phase, 110/120 volts is satisfactory for small motors used intermittently; three-phase 208/240 volts best for larger motors using greater amount of power (½ horsepower and over).

E. All convenience outlets should be of the three-prong grounded type.

F. Pilot-light indicators need be provided for equipment that employs electrically heated elements.

G. All electrical installations must be made according to the National Electrical Code.

Industrial arts instructional laboratories with the exception of the drafting room will require the high voltage, three-phase power system. Either 120/208 volts, three-phase or the 277/480 volts, three-phase grounded electrical system is recommended. Extreme care must be exercised when writing specifications for motors and other electrical apparatus. These specifications must be in accordance with the system installed in the facilities. For example; if the 208 volt system is installed, all motors one-half horsepower or larger should be wired specifically for this particular system.

UTILITIES

Often neglected but important in the operation of industrial arts laboratories are the utility needs — water, gas, air and plumbing. Water needs include two types of sinks: (1) a work type sink with hot and cold water for cleaning equipment, mixing, and quenching work pieces; (2) a hand washing sink which is round, half-round, or trough type. Sinks in the drafting rooms should be built into a cabinet with a hard finish counter. A drinking fountain should be located in the main laboratory area. Floor drains with grease and sand traps should be provided in the finish rooms and some laboratories such as the power laboratory.

Compressed air is needed in many shops for cleaning machines, spray painting equipment, and air driven tools. Several air outlets should be placed throughout the shop to accomodate ease of utilization. The placement of these outlets will be dictated by the location of various work stations and machines.

Metals, crafts, ceramics, plastics, and power mechanics laboratories will need gas service for furnaces, forges, and soldering equipment. Each individual unit should be installed with a separate shutoff valve nearby. The master shutoff valve for the entire system should be located away from the equipment.

FIGURE II
UTILITY NEEDS

PROGRAM	Hand Washing Facilities	Water for Quenching and other purposes	Gas	Compressed Air	Toilet*	Floor Drain
Drafting	X			X		
Electricity/Electronics	X		X			
Graphic Arts	X	X				X
Dark Room	X	three tray sink				
Industrial Ceramics	X	double sink	X	X		X
Industrial Crafts	X	double sink	X			
Industrial Plastics	X	X	X	X		
Metals	X	X	X	X	X	X
Power Mechanics	X		X	X	X	X**
Woods	X		X	X	X	X

* A central toilet room might serve all laboratories if properly located.

**Floor drain in Power Mechanics Laboratory should have an oil catch or trap.

OTHER CONSIDERATIONS

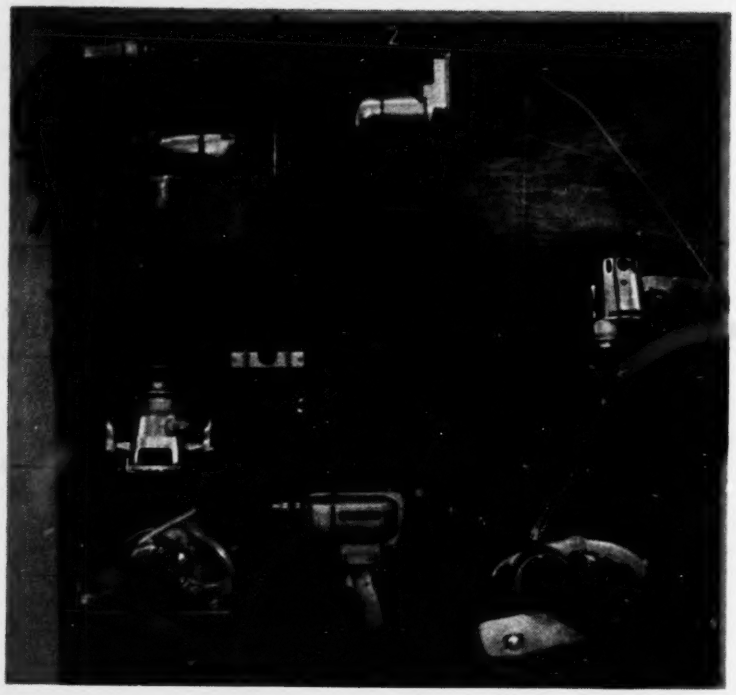
Ceilings — Recommended minimum ceiling height for these instructional areas is 10' to 12'. Ceilings in these areas should be finished in the same manner as other classrooms in the building. Unfinished ceilings with exposed joints are unattractive and difficult to maintain. In addition to this, they usually have unsatisfactory sound-absorption and light-reflective factors. Properly installed acoustical ceiling covering contributes greatly to the sound control in this instructional area.

The following chart covers other factors that need to be considered.

FIGURE III
MISCELLANEOUS CONSIDERATIONS

INSTRUCTIONAL AREA	RECOMMENDED WORK SURFACES	RECOMMENDED FLOOR COVERINGS*	OUTSIDE ENTRANCE RECOMMENDED
Drafting	Vinyl, Plastic & Wood	Vinyl & Carpeting	
Electricity	Plastic & Wood	Vinyl	
Graphic Arts	Plastic, Vinyl, Metal & Stone	Vinyl	X
Ind. Ceramics	Wood & Plastic	Concrete or seamless vinyl	
Ind. Plastics	Wood, Metal & Plastic	Concrete or Vinyl	
Ind. Crafts	Wood & Metal	Concrete or Vinyl	
Power Mechanics	Wood & Metal	Concrete or wood	X Overhead Door
Woods	Wood	Vinyl and wood	X Double or Overhead Door
Metals	Wood and Metal	Concrete and wood	X Double or Overhead Door

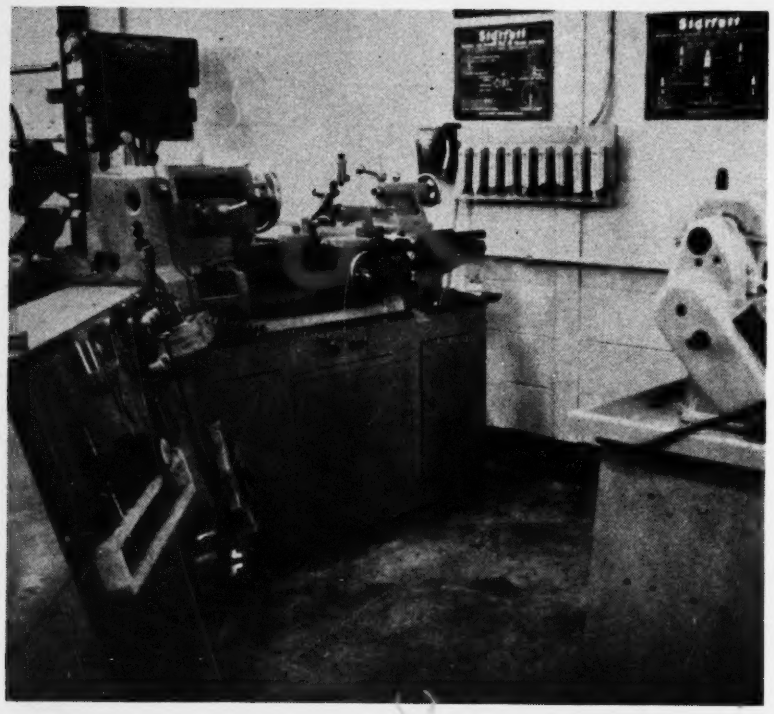
*Use non-skid materials around major fixed machines for safety purposes.

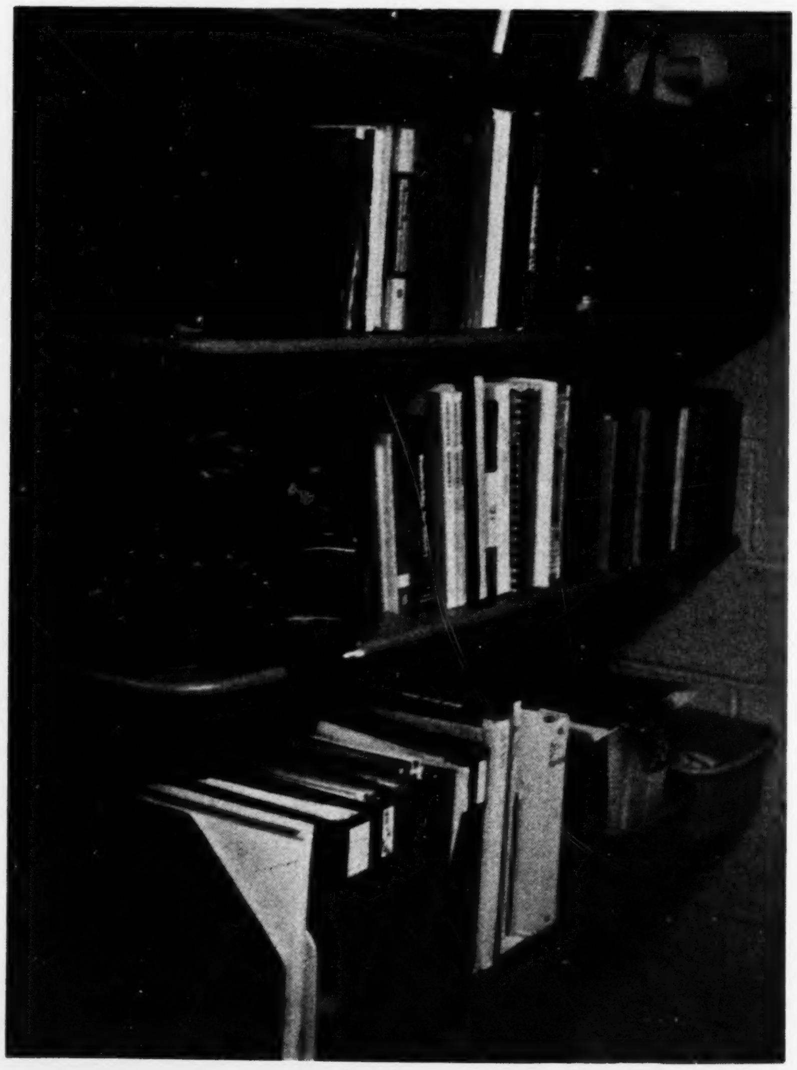


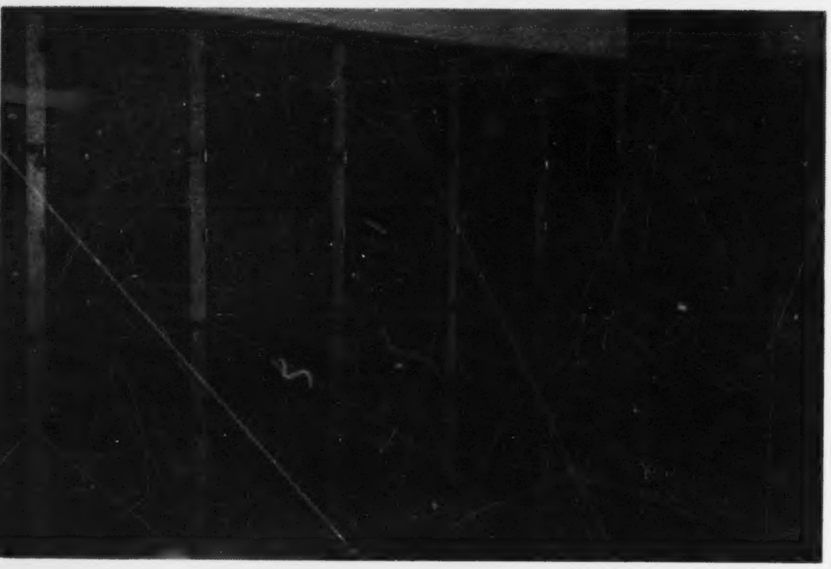
PART III

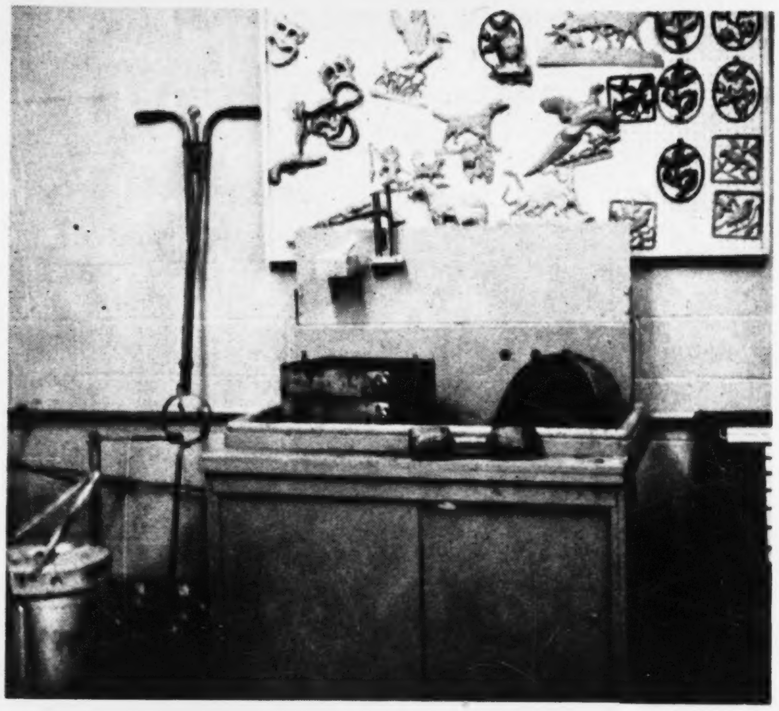
THE PROGRAM AND SPACE NEEDS

- General Description and Objectives
- Recommended Course Offerings
- Space Allotment
  - Area laboratories
  - Auxiliary Areas
  - Storage
- Growth and Expansion
- Departmental Library or Resource Center









PART III

THE PROGRAM AND SPACE NEEDS

GENERAL DESCRIPTION

The basic element of the industrial arts program is the study of industry and its associated technology. As formally organized in the school program, it is a body of subject matter planned to develop skills, understandings, and attitudes related to industry and technology. Learning experiences involve activities such as experimenting, designing, constructing, and evaluation through the application of tools, machines, materials, and processes which provide opportunities for creativity and problem solving.

Industrial arts is frequently defined as a phase of general education (common learnings desirable for all), which is acceptable at the elementary and junior high school level; however, this limited definition is not adequate for the senior high school. Industrial arts has educational value beyond common learnings, as it also contributes to the specialized needs and interests of individuals. This restricted definition of industrial arts resulted from past attempts to dichotomize education into two categories — general and vocational.

The present frame of reference for industrial arts is based upon the concept of an educational continuum ranging from general to specialized education. Specialized education encompasses those school experiences designed to take into account and/or promote unique interests, needs, and abilities rather than those that are common to all. Industrial arts can meet many specialized needs of youth at the secondary or post-secondary level. Although some of these needs are occupational, there are many that are not directly related to occupational life.

The systematic study of industry and technology is an essential part of the education of all youth from the elementary school through college. At each educational level, the subject is organized to take advantage of the interests and needs of the student.

Industrial arts education provides an opportunity for individuals to participate in direct experiences involving industrial skills and processes which fosters an awareness of industry in American culture. These experiences are concrete, meaningful, and have educational value as they aid the individual in understanding abstract ideas. These experiences provide opportunities for an individual to apply mathematics, science, art, language arts, and other school subjects on purposeful situations.

Industrial arts education aids in the discovery and development of personal interests, aptitudes, creative thinking and technical abilities. Responsible and resourceful actions and judgments are matured through problem solving and self-expression in an environment related to industry. The future scientist or engineer may learn to solve technical problems, and the future technician or craftsman may develop skills and related understandings in industrial arts courses.

OBJECTIVES

Realistic objectives, clearly stated, are essential to a sound program of industrial arts education. The following statements of purpose are fundamental to quality industrial arts education as it provides opportunities for students to:

* Develop an insight and understanding of tools, machines, materials, and processes as they relate to the production and servicing aspects of industry. The field of industrial arts education is concerned with the study of materials and processes of industry and the creative use of design. Students of industrial arts education have an opportunity to gain a better understanding of mass production, automation, and other industrial methods if they actively participate in meaningful experiences dealing with the manufacturing of consumer goods, utilization and generation of energy as well as the servicing, testing, and repairing of industrial products.

* Discover and develop abilities, aptitudes, and interests related to the technical pursuits and applied sciences.

Opportunities for students to have experiences which assist in the discovery of abilities and to develop their potentialities to the fullest is essential to the basic education of all youth. Allowance for differences of abilities, interests, and needs should be incorporated into the curriculum offerings so the student can better assess his abilities and interests for making an occupational choice, understanding his environment, and preparing himself to meet the changing demands of a technological society.

* Develop basic skills in the safe and proper use of industrial materials, tools, machines, and processes.

Students are provided with experiences which help them develop basic skills relevant to industrial production and servicing. Through these experiences, students gain a basis for making occupational choices. In addition, the skills provide a basis for specialized occupational preparation. Many workers of the future will be required to train and retrain for different occupations during their lifetime. Fundamental skills and knowledge in diversified areas are most essential if this retraining is to be accomplished in an efficient manner.

* Develop problem-solving and creative abilities relating to the tools, machines, materials, processes, and products of industry.

The industrial arts education program provides opportunities for solving various types of technical problems through research and experimentation as well as project planning and construction. The industrial arts laboratory setting provides an environment which makes possible a concrete, understandable approach to the development of critical thinking and problem solving skills. Problem-solving in industrial arts education involves creative thinking and provides experiences which allow students to find solutions to problems and to evaluate the effectiveness of these solutions.

The preceding general description and objectives are as they appear in the Handbook for Industrial Arts Education — 1969 published by the Missouri State Department of Education.

RECOMMENDED COURSE OFFERINGS

Figure IV, page 3-3 indicates the recommended sequence by levels for Industrial Arts Courses as outlined in the **Handbook for Industrial Arts Education**, page 2-2.

FIGURE IV
RECOMMENDED SEQUENCE BY LEVELS FOR INDUSTRIAL ARTS COURSES

LEVEL I Grades 6-7-8-9

EXPLORATORY INDUSTRIAL ARTS. (General Shop)

This course offers a wide range of experiences in a comprehensive general shop, or in several area shops depending on the facilities available. Experiences will be provided which encompass the study of areas such as: metals, drafting, electricity, graphic arts, ceramics, power, plastics, wood, and leather. Possible organizational patterns are shown in Appendix B on pages 6 & 7 of the Handbook for Industrial Arts Education.

LEVEL II* Grades 9-10-11-12

Suggested Courses or Content Areas

Drafting	Electricity	Graphic Arts	Industrial Ceramics	Industrial Crafts	Metals	Industrial Plastics	Power Mechanics	Woods	Innovations or Combinations

LEVEL III Grades 10-11-12

Suggested Courses or Content Areas

Machine Drafting Technical Drafting Architectural Drafting Graphics	Advanced Electricity Electricity/ Electronics Electrical Power	Printing Photography Offset Lithography		Metal Machining Sheet Metal Welding Metal Technology	Plastics Technology	Power/ Systems Aerospace Technology	Wood Machining Wood Technology	Industrial Mechanics

Suggested Content Areas LEVEL IV Grades 11-12

Advanced or experimental work in a specialized phase of industrial arts; courses named accordingly. Prerequisite: Level III work in the same area, or special arrangement approved by the instructor.

*1. Beginning at Level II the student with special interest in the field of Industrial Arts, should be encouraged to schedule in his high school program, according to ability and time, supporting subjects such as Industrial Mathematics, General Physics, Algebra I, elementary Trigonometry, and Geometry I.

2. Students may enter vocational-industrial or technical education courses upon successful completion of related Level II or Level III in industrial arts courses.

SPACE ALLOTMENT

LABORATORIES

For Area Laboratories. The following chart indicates the minimum recommended space allotment for the area laboratories (excluding auxiliary areas).

FIGURE V
RECOMMENDED MINIMUM SPACE ALLOTMENT

	JUNIOR HIGH SCHOOL			SENIOR HIGH SCHOOL		
AREAS	**Square Ft. Per Student**	**Number of Students**	**Square Ft. Per Area**	**Square Ft. Per Student**	**Number of Students**	**Square Ft. Per Area**
DRAFTING	55	24	1320	75	24	1800
IND. CERAMICS	55	24	1320	75	24	1800
IND. CRAFTS	55	24	1320	75	24	1800
IND. PLASTICS	55	24	1320	75	24	1800
GRAPHIC ARTS	55	24	1320	75	24	1800
METALS	70	24	1680	85	24	2040
ELECTRICITY	70	24	1680	85	24	2040
POWER MECHANICS	70	24	1680	85	24	2040
WOODS	80	24	1920	95	24	2280

[1] *For Multi-Area and Comprehensive General Shop Laboratories.* Since the space needs for the multi-area and comprehensive general shop laboratories are greater than those of the area laboratories the following procedure is recommended to determine the minimum space allotment for multi-activity type laboratories (excluding auxiliary areas).

1. Add the total square feet recommended for each area to be included in the multi-activity program.

2. Determine the average of this total and add 1/3 more because it is a multi-activity program.

Example — A Senior High Level I Shop

Woods	2280	
Industrial Crafts	1320	
Industrial Plastics	1320	
Industrial Ceramics	1320	
	6240 ÷ 4 =	1560
1/3 more	+	520
		2080 Sq. Ft.

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[1] Willis H. Wagner, *Planning Industrial Arts Shop*, State College of Iowa, Cedar Fall, Iowa, 1966. Page 11.

AUXILIARY AREAS

The following chart indicates the recommended square feet allotment.

FIGURE VI

AUXILIARY AREA	Drafting	Woods	Electricity	Power Mechanics	Metals	Industrial Crafts	Industrial Plastics	Industrial Ceramics	Graphic Arts	COMMENTS
Classroom or Planning Area										Separate & adjacent to lab or shop with connecting door and windows.
Material Storage	50	100/150	50	100	100	75	75	75	75	See Storage of this section for types of Material storage.
Project Storage	50	200	100	100	125	75	75	75	50	See Storage of this section for types of project storage.
Office	90 100		SAME FOR ALL AREAS							
Dark Room									125	Separate, adjacent, Instructors closet. Observation windows.
Finishing Room	150				100			100		Maze entrance. Observation windows.
Tool Room		75	75	75	75	50	50	50	50	Many instructors prefer tool cabinets throughout the shop.

STORAGE

Two kinds of storage should be considered for the comprehensive general shop — project and material storage. As a rule you can figure approximately 100 square feet for material storage and 150 square feet for project storage.

The storage can vary as follows:

	MATERIAL STORAGE	PROJECT STORAGE
Drafting	Cabinets & shelves	Pigeon-holes or drawers
Electricity	Cabinets & shelves in lab or separate room	Separate room with shelves
Graphic Arts	Shelves in cabinets or separate room (shelves 26" deep)	Cabinets or separate room with shelves for laying material flat.
Metals	*Racks for storing sheet metal 4' X 14'. Racks for storing flats, angles, etc. up to 21' in length.	Floor space in a separate room for large projects & shelves for small projects.
Woods	*Racks to hold lumber up to 14'. Racks for plywood 4' X 8'.	Floor space in separate room for large projects & shelves for small projects.
Power Mechanics	Shelves, cabinets, and benches in separate room	Shelves, cabinets, & benches in separate room.
Industrial Plastics	Shelves in cabinets	Shelves in separate room or cabinet or lockers.
Industrial Crafts	Shelves in cabinets	Shelves in separate room
Industrial Ceramics	Shelves in cabinet or separate room	Shelves in cabinet or separate room.

Small supplies storage should provide for such things as nails, screws, glue, etc. Built-in cabinets with drawers or metal bins or shelves provided for this small supply storage.

Finish room storage should provide fireproof cabinets for finishing supplies, paint varnish, lacquer, etc. If adult evening classes will use the facilities consideration must be given to project and supply storage. The supply storage is necessary if different instructors are employed for the adult classes. Consideration should also be given to storage of custodial supplies, etc.

*Racks can be made of 2" pipe or angle iron. Racks can be fastened to the wall or stand alone on the floor.

GROWTH AND EXPANSION

It is suggested that generally two instructional laboratories be provided in schools with enrollment up to 250 — a drafting room and a comprehensive general shop. For each additional 250 students, an additional laboratory may be required. When more than two laboratories are provided, specialized unit, area, or multi-area laboratories may replace the comprehensive general shop. In larger schools a duplication of similar laboratories may be provided to meet local requirements.

As school enrollments increase, provisions need to be made for orderly growth and expansion of the various instructional areas and departments. Frequently, it is necessary to utilize a particular classroom or laboratory for more than one area of instruction. Therefore, it is advisable to cluster the instructional areas that are somewhat similar or compatable. This is a method of "phasing in" additional areas to enhance the instructional program. Figure VII indicates the compatible instructional areas.

FIGURE VII
COMPATIBLE AREAS

Size of School	Laboratory No. 1	Laboratory No. 2	Laboratory No. 3
Small School	Drafting Graphic Arts Electricity	All other areas	
Medium & Large Schools	Drafting Graphic Arts Electricity	Woods Industrial Crafts Ind. Plastics* Ind. Ceramics	Metals Power Mechanics Electricity*

*Can operate in Laboratory No. 2 or 3.

DEPARTMENTAL LIBRARY OR RESOURCE CENTER

There has been a great deal of discussion in recent years about a combination departmental resource center and planning area. This area would serve as the library for study; designing and sketching; for audio-visual aids utilization by individual and for group instruction.

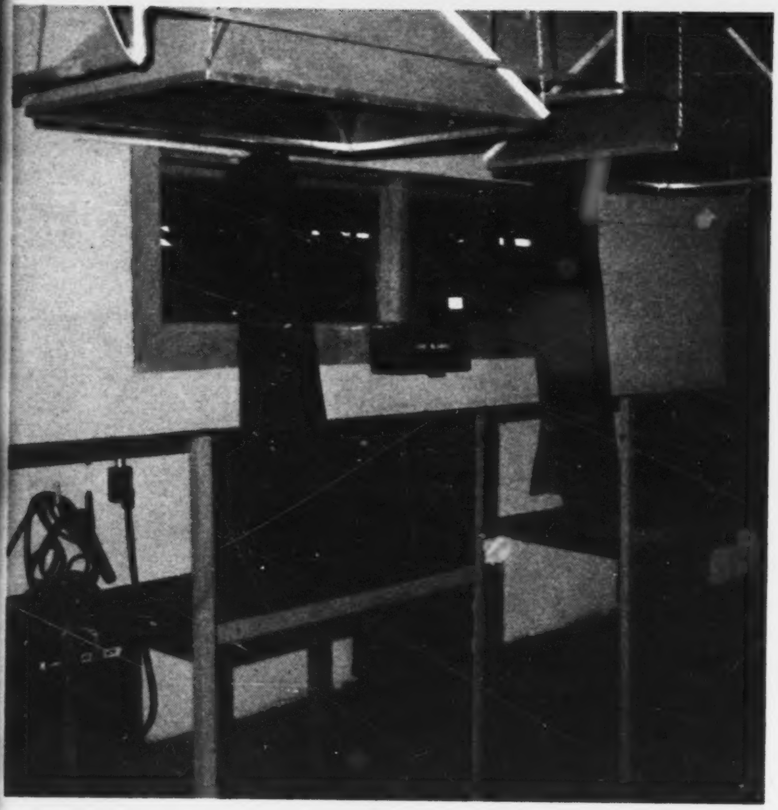
A space of approximately 600 square feet located in or between laboratories would be convenient. This room should be enclosed with glass partitions, so the instructor could visually supervise the pupils' activities without being in the area.

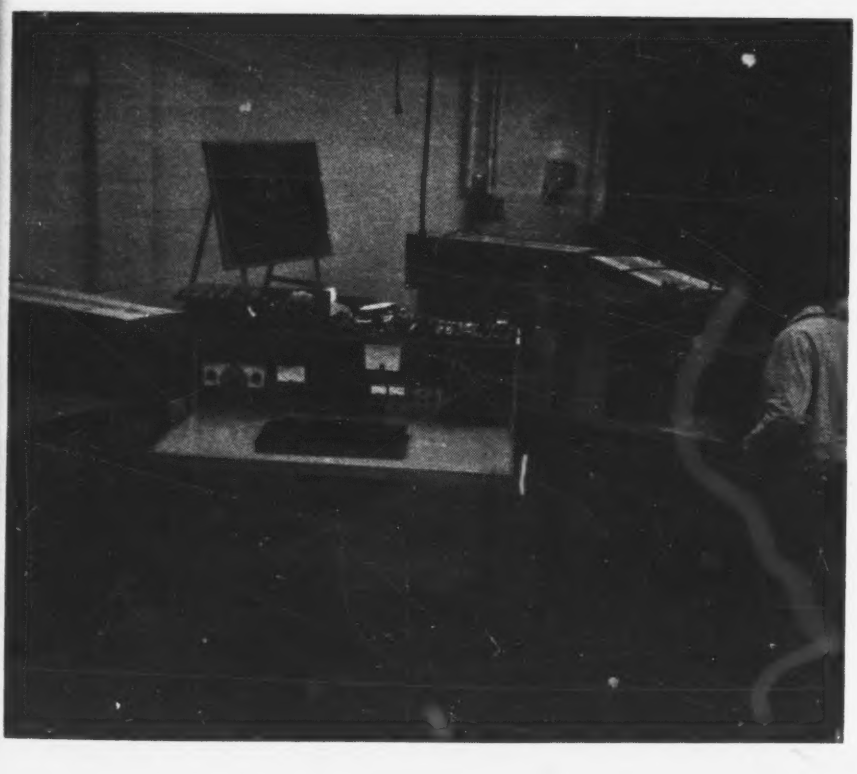
The library should be provided with: chalkboard, bulletin board, reading and drafting tables and chairs, storage space, bookcases, magazine racks, card files, and filing cabinets, space for instructional equipment, teaching aids, and displays; electrical outlets for various items of audio-visual equipment.

PART IV

EQUIPMENT AND FURNITURE

Basic Principles of Equipment Layout
Recommended Equipment Lists
  - Elementary Industrial Arts
  - Exploratory Industrial Arts (General Shop)
  - Drafting
  - Electricity/Electronics
  - Graphic Arts
  - Industrial Ceramics
  - Industrial Plastics
  - Metalworking
  - Power
  - Woodworking





PART IV

EQUIPMENT AND FURNITURE

BASIC PRINCIPLES OF EQUIPMENT LAYOUT

Arrangement of equipment and furniture will naturally be influenced by the curriculum and the methods of instruction. However, the following suggestions will be helpful in the placement of equipment in many situations.

1. All work stations must include sufficient floor area for the equipment and the student, so the operations can be performed safely and without interference from the other work stations or laboratory traffic.

2. Hazardous work stations and equipment should be "pocketed" and otherwise protected to isolate the worker and to insure safety to other students in the laboratory to minimize the possibility of accidents. These stations may be located some distance from the main entrance and away from major traffic lanes.

3. The equipment should be arranged so that the material being processed does not interfere with other work stations or laboratory traffic. Position equipment to allow for material clearance such as saws, planers, and joiners require 12 to 16 feet front and back.

4. Arrange tall equipment so that visual control throughout the laboratory will not be obstructed.

5. Arrange equipment having related operations so the proper sequence of work can be easily followed with a minimum of student and material movement.

6. Position equipment to provide for safe operation by the operator and to protect other students. For example, the circular saw must be located so that a kick-back will not endanger other students.

7. Provide distinct travel aisles between major areas such as supply centers, storage, tool centers, planning areas, and entrances. Heavy traffic areas should be at least four feet wide. Operators should not be in traffic aisles when operating equipment.

8. Arrange work stations, tool panels, and supply centers so the operations and processes of an activity can be carried out by the students with a minimum of travel.

9. Provide extra space where students tend to congregate, such as around lockers, entrances, and tool panels.

10. Group equipment that have similar requirements for dust collection, ventilation, power, air or gas. Adequate ventilating hoods are also essential.

11. Provide work surfaces next to equipment such as drill presses, jointers, shapers and saws where additional work pieces can be stacked.

12. Arrange equipment so that it can be easily cleaned, maintained and serviced.

13. When locating equipment, be certain to include and show on drawings special features necessary for safe and efficient operation. Arc welding, for example, must be confined to some kind of a booth because of the harmful flash.

RECOMMENDED EQUIPMENT LISTS

The following equipment lists are taken from the publication **A Guide for Equipping Industrial Arts Facilities.** Copies of this publication, NEA Stock No. 641-20290, may be obtained from the American Industrial Arts Association, 1201 16th Street N.W., Washington, D.C. 20036 at a cost of $4.75.

HOW TO USE THE EQUIPMENT LISTS

It should be emphasized that the lists presented in each Section are provided as recommendations and should be considered open and flexible. They are suggested only as a guide.

Any selection of equipment and tools for inclusion in these lists necessarily involves choices among alternatives. It is not intended that any one school should buy all of the items recommended, nor is this necessary. However, the purchase of all items in each list would assure the kind and amount of equipment sufficient to carry on basic processes within each area.

Each list contains the following information:

Section

Level — Note that the traditional school grade level is avoided in this listing; introductory experiences are considered as basic regardless of the grade level at which they are offered.

Subsection — Tools and equipment have been grouped according to their common use or association, and have been listed within subsection lists.

Item — The common name of the tool, machine, or furnishing.

Number — The quantity recommended is for a class of approximately 24 students. Two Sections (Elementary and General Shop) have unique requirements; instructions for these Sections appear with their respective lists.

ELEMENTARY INDUSTRIAL ARTS

NOTE: Quantities of tools presented in this list are arranged into columns according to the requirements of different types of elementary school programs:

Column I — Schools with central activities room for approximately 24 students.
Column II — Activity room adjacent to regular classroom for 4-8 students.
Column III — Work bench(es) and/or tool cabinet in regular classroom — 4-8 students.
Column IV — Portable tool kit or cabinet — 4-24 students.

Grade level designations in the list are as follows:

A — recommended for K and grades 3
B — recommended for grades 4-6
C — recommended for grades 7-8 (when included as a part of the elementary school).

I. Woodworking Tools	Quantities Recommended Column: I	II	III	IV	Grade Level
I. WOODWORKING TOOLS					
Awl, Scratch — 6"	1	1	1	1	ABC
Bench Hook wood, approx. 5/8" x 5" x 10"	6	6	6	6	ABC
Bench, Saw 13" x 24" x 18"H	1	1	1	1	ABC
Bit, Auger (set) sizes 4-16	1	1	1	1	ABC
Bit, Expansive from 7/8" to 3"	1	1	1	1	BC
Brace, Ratchet — 10"	2	2	2	2	ABC
Brad Driver automatic, self-centering	1	1	1	1	ABC
Burnisher — 4½" blade	1	1	1	1	BC
Chisel. Butt (set) 3" blade, sizes ¼", ½", ¾", 1", 1¼", 1½"	1	1	1	1	C
Chisel, Carving (set) approx. 6"	1	1	1	1	ABC
Chisel, Cold (set) cutting edge of ¼", 3/8", ½", ¾"	1	1	1	1	BC
Clamp, Bar (36")	2	2	2	2	BC
Clamp, "C" (2")	12	6	6	12	ABC
Clamp, "C" (3")	24	12	12	24	BC

I. Woodworking Tools (cont.)	Quantities Recommended Column: I	II	III	IV	Grade Level
Clamp, Spring (no. 2)	12	12	12	12	ABC
Drill, Hand (¼")	3	2	2	2	ABC
Files (assorted sizes, shapes, and cuts, with handles, as specified)					
Length / Name or Shape / Cut					
8" Cabinet (half-round)	12	12	12	12	ABC
8" Mill Second-Cut	6	6	6	6	ABC
8" Square Second-Cut	6	6	6	6	ABC
8" Round Second-Cut	6	6	6	6	ABC
File, Card and Brush 9½", brush 1½" x 5"	4	2	2	2	ABC
Gauge, Auger bit	1	1	1	1	ABC
Hammer, Claw (7 oz.)	6	4	4	6	ABC
Hammer, Claw (10 oz.)	6	4	4	6	ABC
Hammer, Claw (13 oz.)	4	1	1	4	ABC
Jointer (6") floor model; motor ½ HP, 60 cycles; 3-phase; 220V, with magnetic switch and overload protection	2				BC
Knife, Putty approx. 1"W	1	1	1	1	ABC
Knife, Sloyd blade approx. 2 5/8"L	2	2	2	2	ABC

I. Woodworking Tools (cont.)	Quantities Recommended Column: I	II	III	IV	Grade Level
Miter Box with 26" x 4" back saw	1				ABC
Nail Set (1/16" tip)	1	1	1	1	ABC
Nail Set (3/32" tip)	1	1	1	1	ABC
Plane, Block 1 5/8" cutter	2	2	2	2	A
Plane, Smoothing length 9", blade width 1¾"	1	1	1	1	C
Sander, Finishing heavy duty	1	1	1	1	BC
Saw, Back (12")	6	4	4	6	ABC
Saw, Compass (set)	1	1	1	1	ABC
Saw, Coping 6½" pin end	12	8	8	12	ABC
Saw, Hand, Crosscut 22", 10 point	6	2	2	6	ABC
Sawhorse (18")	8	4	4	8	ABC
Sawjack approx. 5/8" x 5" x 10"	24	6	6	24	ABC
Scraper, Cabinet 2¾" blade	4			4	BC
Scraper, Hand approx. 3" x 5" steel blade	2	2	2	2	ABC
Vise, Woodworker's portable; clamps on type	2	2	2	2	ABC

II. METALWORKING TOOLS

Divider, Wing 6" steel	1	1	1	1	ABC
Dresser, Grinding wheel	1	1	1	1	ABC
File Card and Brush 9½"L, brush 1½" x 5"	24	24	24	24	ABC
File, Needle (set) set of 12, 5½"L, assorted shapes	1	1	1	1	ABC

II. Metalworking Tools (cont.)	Quantities Recommended Column: I	II	III	IV	Grade Level
Gauge, Wire and sheet metal (American) sizes 0-36	1	1	1	1	ABC
Gauge, Wire and sheet metal (U.S.S.) sizes 0-36	1	1	1	1	ABC
Hammer, Ball peen (2 oz.)	2	2	2	2	ABC
Hammer, Ball peen (4 oz.)	4	4	4	4	ABC
Hammer, Chipping	1	1	1	1	ABC
Kiln, Enameling interior 4" x 8½"; 110V AC; 10 amps.	1	1	1	1	BC
Punch, Center (set) set of 5; 1/16" to ¼"	1	1	1	1	BC
Punch, Hand (set) set of 7; 3/32" to 9/32"	1	1	1	1	BC
Riveter, "Pop" (set) adjustable to receive 9"-12" blade	1	1	1	1	BC
Saw, Hack (hand) 8"	1	1	1	1	BC
Sheet Metal Tool 10"L	1	1	1	1	BC
Snip, Aviation (combination and straight)	1	1	1	1	ABC
Snips, Tinner's, Straight (no. 8)	1	1	1	1	ABC
Soldering Copper, Electric (60W) ½ copper tip with stand	1	1	1	1	BC

III. PLASTICS TOOLS

Hot Plate, Electric 110V	1			1	ABC
Oven 12"W x 10"H x 10"D; adjustable shelves; 220V; 3-phase or 110V; single-phase	1				ABC

III. Plastics Tools (cont.)	Quantities Recommended Column: I	II	III	IV	Grade Level
Strip Heater 23" minimum length; 110V, 250W	1	1	1	1	ABC
Thermoforming Press, Vacuum (small) approx. maximum set size 8" x 8", 110V heater	1				ABC

IV. LEATHERWORKING TOOLS

	I	II	III	IV	Grade Level
Beveler	5	5	5	5	ABC
Board, Cutting approx. ¾" x 8" x 10", maple	24	6	6	24	ABC
Chisel, Thonging (4-prong) (1/8")	1	1	1	1	ABC
Chisel, Thonging (3-prong) (1/8")	2	2	2	2	ABC
Chisel, Thonging (single-prong) (1/8")	2	2	2	2	ABC
Chisel, Thonging (single-prong) (3/32")	1	1	1	1	ABC
Eyelet Setter	1	1	1	1	ABC
Gauge, Draw	1			1	ABC
Knife, Carving (set) to include 3 blades no. 1, no. 2, no. 6 sizes	2	2	2	2	BC
Knife, Head 4½"L; 2 3/8" in center	1	1	1	1	ABC
Knife, Skiving	2	2	2	2	ABC
Knife, Swivel cutter	4	4	4	4	BC
Mallet, Rawhide 10 oz.	12	4	4	12	ABC
Punch, Leather, Revolving (8"L)	1	1	1	1	BC
Sewing Machine portable or upright	1				BC
Skife	2			2	ABC
Snap Fastener (set)	2	1	1	2	ABC

IV. Leatherworking Tools (cont.)	Quantities Recommended Column: I	II	III	IV	Grade Level
Stamp, Leather (set)					ABC
Veiner, Leather stamp	3	3	3	3	ABC

V. GRAPHIC ARTS TOOLS

	I	II	III	IV	Grade Level
Brayer, Block printing 4" width	4	4	4	4	BC
Cutter, Linoleum (set) (push-type)	6	4	4	6	BC
Cutter, Linoleum (set) (pull-type)	6	4	4	6	BC
Press, Block printing	1	1	1	1	BC
Slab, Inking approx. 6" x 6" x ¼"T or heavier	1	1	1	1	ABC

VI. CERAMICS TOOLS

	I	II	III	IV	Grade Level
Gloves, Asbestos (pair)	1				BC
Kiln, Electric fire chamber 6½" x 7" x 4"; temp. 3,000 F; 208V or 220V AC	1				ABC
Modeling Tool (set) kit of 10 tools	3	3	3	3	ABC
Pyrometer, Portable 30" thermocouple; range to 2500 F	1				ABC
Sponge, Elephant ear shape	1	1	1	1	ABC
Stilts, Kiln	144				ABC
Triangle, Kiln	144				ABC

VII. WEAVING

	I	II	III	IV	Grade Level
Loom, Table 4 harness; 8" weaving space	3			3	BC
Needle, Knitting (pair) 10"	12	6	6	12	BC
Needle, Raffia (card) 2 needles; 1 straight, 1 curved	24	8	8	24	ABC

VIII. General Furnishings	Quantities Recommended Column: I	II	III	IV	Grade Level
VIII. GENERAL FURNISHINGS					
Bench, Elementary, Work wood; craft type; 4 station; top approx. 36" x 47" recommended height; K-24"; primary-27"; intermediate-30" with storage	6	1 to 6	2		ABC
Bench, Woodworking (4 place) 2¼" x 54" x 64" laminated maple top; 2 base units; 36" x 21" x 31"H; equipped with 4 vises	6	2	2		ABC
Blow Torch portable; propane	1			1	BC
Bookcase approx. 60"H x 10"-12"D x 72"L, 3 adjustable shelves, wood or metal	1	1	1	1	ABC
Broom, Push 18" in length	3	3	3		ABC
Brush, Bench	12	4	4	6	ABC
Buffer, Pedestal 2-6" x 1" muslin wheels; wide clearance design; motor 1/3HP; 1725 RPM; 115 V; single phase; 60-cycle; manual starter with overload protection	4				BC
Cabinet, Filing 4 drawer, 52"H x 15"W x 28½"D	1	1	1		ABC
Cabinet, Storage steel construction, approx. 36" x 48" x 24"D		1	1		ABC
Cart, Stock metal construction, approx. 36"L x 24"W x 32"H	1			1	ABC
Cart, Tool mobile unit; equipped with "junior size" tools when possible, to accomodate up to 20 students				1- 2	ABC
Chair, Teacher's welded steel construction, swivel, with casters	1	1	1		ABC

VIII. General Furnishings (cont.)	Quantities Recommended Column: I	II	III	IV	Grade Level
Compass, Pencil	6	6	6	6	ABC
Cutter, Glass	1	1	1	1	ABC
Desk, Teacher's approx. 42" x 30" x 29"H, welded steel construction	1	1	1		ABC
Drill, Electric Portable (¼")	1	1	1	1	ABC
Drill Stand, Fractional for twist drills from 1/16" to 1/2" by 64ths	1	1	1	1	ABC
Drill, Twist, Straight shank (fractional set) high speed steel, by 64ths 1/16" to 1/2"	1	1	1	1	ABC
Fire Blanket	1	1	1	1	ABC
Fire Extinguisher	2	2	2		ABC
First Aid Kit	1	1	1	1	ABC
Flocking Gun	1				BC
Gloves, Rubber (pair)	1	1	1	1	ABC
Goggles (spectacles), clear observation	10	4	6	6	ABC
Grinder-Buffer, Bench, Combination motor ¼ HP; 1725 RPM; 115V; 60-cycle; with manual starter and overload protection	1				BC
Marker, Felt-tip, Color (set) complete with polishing kit	6	2	2	6	ABC
Oiler, Bench	6	2	2	1	BC
Oilstone, Combination, India course and fine grits, 8" x 1" x 2"	4	2	2	2	ABC
Pan, Dust 12" steel	1	1	1	1	ABC
Pencil Sharpener, Standard	1	1	1		ABC

VIII. General Furnishings (cont.)	Quantities Recommended Column: I	II	III	IV	Grade Level
Pencil, Woodburning	3	2	2	3	ABC
Pliers, Combination (6")	2	1	1	2	ABC
Pliers, Diagonal-cutting (6")	2	2	2	2	ABC
Pliers, Electrician's (8")	1	1	1	1	A
Pliers, Needle nose (6")	1	1	1	1	ABC
Pliers, Vise-grip wrench (7")	1	1	1	1	BC
Projector, Filmstrip (35mm) and slide (2" x 2")	1	1	1		ABC
Projector, Motion picture, Sound	1	1	1		ABC
Projector, Overhead	1	1	1		ABC
Protractor, Semi-circular	2	1	1	2	ABC
Rule, Flexible, Steel tape (8')	1	1	1	1	ABC
Rule, Steel (12")	2	2	2	2	ABC
Sander, Band portable, band 1" x 42", ½HP, 110V AC	1				BC
Saw, Band, Wood-cutting 14" floor model; motor ½ HP; 60-cycle; 208V or 220V; 3-phase; with magnetic switch and starter	1				C
Saw, Circular, Power 10" floor model; motor 1½ HP; 60-cycle; 208V or 220V; 3-phase; with magnetic switch and starter	1	1			ABC
Saw, Jig (scroll) 2", metal stand, 1/3 HP, 60-cycle AC, 115V	1				ABC
Saw, Sabre (bayonet) portable; heavy duty	1			1	BC
Scissors (8")	2	2	2	2	ABC
Screen, Projection	1	1	1		ABC
Screwdriver, Standard bit (set) changeable blades	1	1	1	1	ABC
Screwdriver, Standard bit (round blade) (set) set of 5, blade widths 3/16", ¼", 5/16", 3/8", ½"	1	1	1	1	ABC
Shield, Face	3	1	1	2	ABC
Soldering Gun, Electric	1	1	1	1	C
Spoons, Measuring (set)	1	1	1	1	ABC
Square, Steel framing 12" x 24"	3	1	1	2	ABC
Square, Try (6")	6	2	2	6	ABC
Square, Try (8")	4	2	2	4	ABC
Table, Overhead projector portable, 26"H	1	1	1	1	ABC
T Bevel (6")	1	1	1	1	C
Tumbler, Lapidary 25 lb. cap, ¼ HP motor, 115V AC, 60-cycle	1	1	1		BC
Wrench, Adjustable end (8")	1	1	1	1	ABC

LEVEL I
EXPLORATORY INDUSTRIAL ARTS (General Shop)

I. General	Quantity
I. GENERAL	
Awl, Brad	2
Awl, Scratch (6")	3
Bench, Wall type top 100" x 24" x 2¼"T; laminated top; height 32"; bolted construction	2
Bench, Woodworking (4 place) 2¼" x 54" x 64"; hard maple top; mounted on two 36"W x 21"D x 31"H base units; wood or metal; with 4 vises	5
Bookcase approx. 50"H x 10-12"D x 72"L; 3 adjustable shelves; wood or metal	1
Broom, Push 18" in length	3
Brush, Bench	12
Brush, Wire overall length 10"-14"; width 1"; wire length approx. 1-3/16"	6
Buffer, Pedestal	1
Cabinet, Filing 4 drawer; size 52"H x 15"W x 28½"D	2
Cabinet, Finishing (storage) all steel construction; adjustable shelves, 2 door with locks	1
Cabinet, Paper and drawing storage hardwood; 84" x 48" x 24"; adjustable shelves, locks	1
Cabinet, Tool Storage approx. 62"W x 22"D x 84"H	2
Caliper, Inside (6") solid nut	2
Caliper, Inside (8") solid nut	2
Caliper, Outside (6") solid nut	2
Caliper, Outside (8") solid nut	2
Can, Oily waste 10 gallon capacity	2
I. General (cont.)	**Quantity**
Can, Safety (1 qt.)	4
Can, Safety (1 gal.)	2
Chair, Teacher's welded steel construction; swivel base with casters	1
Chisel, Butt (set) 3" blade; plastic handles; sizes ¼", ½", ¾", 1", 1¼", 1½"	2
Clamp, Spring (no. 2)	12
Compass, Pencil	6
Compressor, Air 120 p.s.i.; motor 1½ HP; 3-phase; 208 or 220V; 60 gallon tank	1
Countersink, High speed ¼" shank; ½" size	2
Cutter, Glass	1
Desk, Teacher's approx. 42" x 30" x 29" H, welded steel construction	1
Die, Letter (set) 3/16" character height	1
Die, Number (set) 3/16" character height	1
Divider, Spring (6")	1
Divider, Spring (8")	1
Dresser, Abrasive wheel	1
Drill, Electric, Portable (¼")	1
Extension Cord heavy duty; grounded, 25'	2

I. General (cont.)	Quantity
Files (assorted sizes, shapes, and cuts, with handles, as specified)	

Area	Length	Name or Shape	Cut	
	8"	Flat Double-Cut	Bastard	2
	10"	Flat Double-Cut	Bastard	2
	6"	Half-round	Bastard	2
	8"	Half-round	Bastard	2
	10"	Half-round	Bastard	2
	8"	Half-round	Second-Cut	2
	10"	Half-round	Second-Cut	2
	8"	Mill	Second-Cut	2
	10"	Mill	Second-Cut	2
	8"	Rat-tail (Round, Slim)	Second-Cut	2
	8"	Round	Second-Cut	2
	10"	Round	Second-Cut	2
	6"	Slim, Taper	Single-Cut	2
	8"	Square	Second-Cut	2
	8"	Square	Smooth	2
	10"	Vixen (Half-round)		2
	8"	Wood (Flat)	Coarse	2
	10"	Wood (Flat)	Coarse	2
	8"	Cabinet (Half-round)		2
	10"	Cabinet (Half-round)		2
	8"	Cabinet Rasp (Half-round)	Bastard	2
	10"	Cabinet Rasp (Half-round)	Bastard	2
	6"	Slim, Taper	Single-Cut	2

File, Auger bit 7"; standard cut	1
File Card and Brush 2½"L; brush 1½" x 5"	6
Fire Blanket	1
Fire Extinguisher	3
First Aid Kit	1
Gauge, Wire and sheet metal (American) sizes 0-36	2
Gauge, Wire and sheet metal (U.S.S.) sizes 0-36	2
Goggles (spectacles), Clear observation	12

I. General (cont.)	Quantity
Grinder, Oil tool	1
Hammer, Soft face (4 oz.)	2
Knife, Putty approx. 1"W; flexible tool; steel blade	3
Knife, Sloyd blade approx. 2 5/8"L	6
Mallet, Hardwood	2
Mallet, Rawhide (10 oz.)	2
Oiler, Bench 1/3 or 1/2 pint size; 5" straight spout	3
Oilstone, Combination, India coarse and fine grits; 8" x 1" x 2"	1
Oilstone, Combination, Silicon carbide coarse, fine; 8" x 1" x 2"	1
Pan, Dust 12" steel	2
Pencil Sharpener, Standard	1
Pliers, Combination (6")	2
Pliers, Combination (8")	2
Pliers, Diagonal-cutting (6")	2
Pliers, End-cutting	2
Press, Drill (15") 15" capacity; variable speed; no. 2 Morse taper in spindle; floor model; ½" key chuck; tilting standard table; with ½ HP, 208V or 220V, 3-phase motor, and magnetic switch and starter	1
Projector, Filmstrip (35mm) and slide (2" x 2")	1
Projector, Motion picture, Sound	1
Projector, Overhead	1
Punch, Center (set) set of 5; 1/16"-¼" diameter	2
Punch, Pin (set) 4"L; set includes diameter from 1/16"-1/2" by 32nds	1
Rule, Flexible, Steel tape (6')	3
Rule, Steel (12")	6

I. General (cont.)	Quantity
Rule, Steel (36")	3
Sander, Belt, Portable, Electric 3" x 24" or 4" x 24"; 115V AC motor	1
Sander, Combination belt and disc 6" belt and 12" disc; floor model with metal stand; motor 1 HP; 60-cycle; 208 or 220V, 3-phase with magnetic switch and starter	1
Sander, Finishing, Portable, Electric heavy duty	1
Saw, Hack (hand) adjustable to receive 9"-12" blade; tubular body	3
Saw, Hack, Close quarter	1
Saw, Jeweler's (4")	1
Scissors (8")	1
Screen, Projection (60" x 60")	1
Screwdriver, Cabinet tip (4" and 6")	2
Screwdriver, Offset Phillips (set)	1
Screwdriver, Phillips (set) set with points no. 1, no. 2, no. 3	1
Screwdriver, Standard bit (round blade) (set) set of 5; blade widths of 3/16", 1/4", 5/16", 3/8", 1/2"	2
Screwdriver, Standard bit ("stubby") square shank	2
Shield, Face	6
Snips, Tinner's, Straight (no. 8)	2
Soldering Copper, Electric (60W)	2
Spray Gun Outfit	1
Square, Combination (12")	2
Square, Combination (set) (with protractor and center head) 12"	1
Square, Steel framing (12" x 24")	2
Stapler, hand 8½"; throat depth 4"	1
Stool, Student's, adjustable 14" seat with back	6

I. General (cont.)	Quantity
Table, Blueprint (24" x 6")	1
Table, Drafting overall size approx. 38" x 28" x 39"H; wood or metal; or overall size approx. 38½" x 48" x 29"H wood or metal	6
Table, Overhead projector	1
Tap and Die, NC (U.S. standard) (set) ¼-20, 5/16-18, 3/8-16, 7/16-14, ½-13, complete with die stock and tap wrench	1
Tap and Die, NF (S.A.E.) (set) ¼-28, 5/16-24, 3/8-24, 7/16-20, ½-20, complete with die stock and tap wrench	1
Trammel points	1
Vise, Bench, Drill capacity opening 3"	1
Vise, Machinist's bench swivel base, 3" jaw, 4¾" opening	4
Vise, Swivel 2" jaw, rapid positioning	1
Wrench, Adjustable end (6")	2
Wrench, Adjustable end (8")	1
Wrench, Adjustable end (10")	1
Wrench, Adjustable end (12")	1
Wrench, Allen key (hex) (set) set of 11; no. ½ - no. 12	2
II. CERAMICS (CRAFTS)	
Box, Clay storage, Portable metal lined; with casters	1
Cabinet, Damp-proof size 18"D x 26"L x 31"H	1
Cabinet, Drying base height; 18"D x 36"L x 31"H	1
Kiln, Electric fire chamber; 6½" x 7" x 4"; temp. 3,000 degrees F; 110V, 14.5 amps.	1
Kiln, Front loading 18" x 18" x 19" chamber; temp. to 2,000 degrees F; 208 or 220-230V AC	1
Modeling Tool (set) kit of 10 tools	2

II. Ceramics (crafts) (cont.)	Quantity
Molds, Ceramics (assorted)	6
Nipper, Tile carbide cutting edges	2
Potter's Wheel, Electric ½ HP motor; 110V, 208 or 220V; variable speeds; 0-120 RPM, table 24" x 30"	1
Tank, Storage, Slip	1
Trivets	6
Wedging Table	1

III. CRAFTS — ENAMELING

Atomizer	1
Fork, Enameling 17½"L	2
Kiln, Enameling 110V AC; welded steel construction; interior 4" x 8½" x 8"	1
Rack, Enameling 4" x 3" mesh	2
Sifter 80 mesh screen	1
Torch, Gas natural gas and air	1
Tweezers, Bevel point	2

IV. CRAFTS — LEATHER

Awl, Stitching, Automatic	1
Chisel, Thonging (set) size 3/32" and 1/8"	2
Creaser, Adjustable edge	1
Eyelet Setter	1
Fid hardwood handle, 2¼"L blade	1
Knife, Leather	2
Knife, Skiving	2
Knife, Swivel cutter	6
Leather Modeling Tool (set)	2

IV. Crafts — Leather (cont.)	Quantity
Needle, Lacing	6
Pencil, Woodburning (interchangeable tips)	1
Punch, Leather, Revolving 6 tubes size; 8"L	2
Shear, Leather (8")	2
Snap Fastener (set)	2
Spacer, Leather marker size 6	2
Stamp, Leather	2

V. CRAFTS — PLASTICS

Molding Press, Injection (small) cap. ¼-¾ oz. of styrene; heater 110V; single-phase; hand operated; mechanical or pneumatic	1
Oven approx. 12"W x 10"H x 10"D; 0-550 degrees F; 208V, 220V or 110V	1
Spatula	1
Strip heater	1
Thermoforming Press, Vacuum (medium)	1

VI. DRAFTING TOOLS

Board, Drafting 18" x 24"—beginning; 24" x 36" or 31" x 42"—advanced	6
Brush, Duster, Draftsman's 2½" bristles; 13" overall length	6
Compass and Divider (set)	6
Compass, Chalkboard 16" minimum length	1
Curve, Irregular (set)	2
Cutter, Paper (24")	1
Eraser Shields size 2½" x 3¾" x .005	6
Lettering Set	1
Machine, Drafting (18")	2
Machine, Reproduction moist type; width capacity 42"	1

VI. Drafting Tools (cont.)	Quantity
Pen Set	1
Pencil Pointer, Lead pencil	1
Protractor, Semi-circular	2
Punch, Paper adjustable; 1-4 holes	1
Scale, Architect's 12" triangular	6
Scale, Decimal (civil engineer's) 12" triangular	1
Staple Remover	1
Triangle, 30 degrees - 60 degrees (8")	6
Traingle, 45 degrees (8")	6
Triangle, Chalkboard (30 - 60) 24" hardwood	1
T Square (minimum size 24")	6

VII. ELECTRICITY — HAND TOOLS

Meter, Ammeter (AC) range 0-25 amps.	1
Meter, Ammeter (DC) range 0-10 amps.	1
Meter, Battery tester	1
Meter, Volt-ohm (multi-range)	6
Meter, VTVM	1
Oscilloscope (5" screen)	1
Pliers, Electrician's (8")	2
Pliers, Long nose (6")	2
Power Supply, Low voltage AC and DC 0-15V; maximum 5 amperes	1
Power supply, Variable output 0-20V AC and DC; 10 amperes	1
Power Supply, Variable output, Filtered 0-300 V DC; 100 ma.	1
Punch, Chassis (round set) 2 piece dies; 7/8", 3/4", 1", 1 1/8"	1
Punch, Chassis (square set) 2 piece dies; ½", ¾", 1"	1

VII. Electricity — Hand Tools (cont.)	Quantity
Screwdriver. Insulated (set) single blades 3/16" by 9/32" with 4", 6" and 8" shafts	2
Signal Generator	1
Soldering Gun, Electric dual heat; 240/325W, spot light	2
Tester, Neon lamp type	1
Tester, Tube	1
Transformer, Bell Primary 110V to 115V AC, Secondary 6, 12 and 18V	3
Wire Cutter and Stripper	3
Wrench, Nutdriver (set) set of 8 drivers; sizes 3/16", 1/4", 9/32", 5/16", 11/32", 3/8", 7/16", 1/2"	6

VIII. ELECTRICITY — GENERAL FURNISHINGS

Bench, Electric (with test panel) 1¾" x 28" x 60"; laminated maple top, solid maple base, lock casters, double door cabinet	1
Electricity Demonstration Panel, Teacher's	1
Electricity Training Panel, Student's	3
Electronics Demonstration Panel, Teacher's	1
Electronics Training Panel, Student's	3

IX. GENERAL METALS — HAND TOOLS

Anvil (100 lb.)	1
Apron, Foundry leather, approx. 44"L	2
Apron, Welding leather, approx. 44"L	2
Bellows, Molder's (8")	1
Bending Jig, Adjustable	1
Bulb, Sponge 8 oz.; rubber bulb	1
Chisel, Cape ½" stock; ¼" cutting edge	2

IX. General Metals — Hand Tools (cont.)	Quantity
Chisel, Cold (set) cutting edge of ¼", 3/8", ½", ¾"	2
Clamp, "C" (3")	3
Clamp, "C" (4")	3
Clamp, "C" (6")	3
Clamp, "C" (8")	6
Cutter, Bolt (minimum 14")	1
Drill, Blacksmith (set) high speed; ½" shank; sizes 5/8", 11/16", 3/4", 13/16", 7/8", 15/16", 1"	1
Extractor, Screw (set) set of 6; no. 1 - no. 6	1
Flask, Foundry (small) 10" x 12"; cope 3" deep; drag 3" deep	3
Gauge, Center (spring tempered)	1
Gauge, Depth rule	1
Gauge, Drill point	1
Gloves, Asbestos (pair) unlined, 14"L, medium size	1
Gloves, Leather (pair) cowhide	1
Goggles, Gas welding	2
Goggles, Melter's	2
Groover, hand (set) set of 3; sizes 0, 2, 4	1
Hammer, Ball peen (4 oz.)	3
Hammer, Ball peen (12 oz.)	3
Hammer, Ball peen (16 oz.)	3
Hammer, Chipping	
Hammer, Engineer's (40 oz.)	1
Hammer, Forming	1
Hammer, Raising	1
Hammer, Riveting, Machinist's (9 oz.)	1
Hammer, Setting (12 oz.)	2

IX. General Metals — Hand Tools (cont.)	Quantity
Hammer, Soft face (8 oz.) with replaceable plastic faces	2
Helmet, Welding (hand type) with no. 10 lens and cover	4
Helmet, Welding (head type) lift top visor; shade no. 10	2
Ladle, Bottom pour 5" diameter of bowl	1
Leggings, Molder's (pair)	2
Micrometer, Outside (1") graduated; .001", with spindle, lock and ratchet adjustment	1
Micrometer, Outside (2") graduated; .001", with spindle, lock and ratchet adjustment	1
Micrometer, Outside (3") graduated; .001", with spindle, lock and ratchet adjustment	1
Mold, Ingot	2
Pliers, Lineman's (6")	1
Pliers, Needle nose (6")	2
Pliers, Round nose (6")	2
Punch, Pin (set) 4"L, set includes diameter from 1/16" to 1/2" by 32nds	1
Punch, Tinner's (set)	1
Rammer, Hardwood	1
Riddle, Foundry wire screen; no. 8 mesh	1
Rivet Set set of 5; sizes no. 3 - no. 7	1
Scriber complete with 3 points; 1 straight, 1 short bent, 1 long bent	2
Seamer, Handy	1
Shovel, Square point	1
Snip, Aviation (left) 10"L	2

IX. General Metals — Hand Tools (cont.)	Quantity
Snip, Aviation (right) 10"L	2
Snip, Aviation (combination and straight) 10"L	2
Snips, Hawksbill 3" cut	1
Snips, Tin, Curved blade (3")	1
Sparklighter	6
Sponge, Bulb (8 oz.)	1
Spoon and Gate Cutter 1" wide	2
Sprinkling Can (galvanized steel)	1
Stake, Beakhorn	1
Stake, Blowhorn	1
Stake, Candle mold	1
Stake, Coppersmith square	1
Stake, Hatchet	1
Stake, Hollow mandrel	1
Stake, Round head	1
Tongs, Blacksmith, Curved lip 20"L	1
Tongs, Crucible 17"L	1
Tongs, Pick-up (flat lips) 24"	1
Torch, Gas (natural gas and air)	1
Torch, Propane (kit) with assorted tips for heating and soldering	1
Trowel, Foundry	1
Trowel, Square, Molder's	1
Trowel, Taper (heart) and leaf, Molder's	1
Truck, Welding cylinder size appropriate to gas bottle size	1
Vise, Sheet metal 3" opening	1

IX. General Metals — Hand Tools (cont.)	Quantity
Welder, Arc (AC/DC)	1
Welder, Spot (portable) 208V or 220V; 10' power cable	1
Welding Outfit, Oxyacetylene including regulators, torch, set of tips; cutting attachments; and set of tips	1
Welding Screen, Portable back 6' x 6'; tubular frame construction; fireproof curtain	1

X. METALS — MACHINES

Bar Folder (30")	1
Bender, Universal on stand; cap. radius 6"-12"; ½" round; mild steel	1
Brake, Box and pan 24"; capacity 16 ga.; depth of box 3"	1
Buffer, Pedestal 2-6" x 1"; muslin wheels, clearance design, motor 1/3HP; 1725 RPM, 115V, single-phase, 60-cycle	1
Forge, Gas	1
Forming Roll, Slip 30"; capacity mild steel; 22 ga.	1
Furnace, Crucible maximum cap. number 16 crucible	1
Furnace, Bench gas, 2 burner	1
Grinder, Pedestal 1" x 7" model; motor ½HP, 60-cycle; 110V, single-phase	1
Lathe, Metalworking (10") distance between centers 24"; cabinet model; 50-1500 RPM; motor ¾HP, 208 or 220V, 3-phase. Equipped with drive plate, spindle adaptors, centers, tool post, ring, rocker, wrench, quick-change gear box, thread chasing dial and 3-jawed chuck.	1
Milling Machine, Vertical approx. range 9" x 40" table working surface, longitudinal table travel 26", cross travel 10", vertical travel of knee 18", vertical travel of spindle 5", turret to rotate 360 degrees on column, head	1

X. Metals — Machines (cont.)	Quantity
to rotate 360 degrees on ram. Other features to be considered: gibs, accuracy and movement of all bearing surfaces, spindle bearings, spindle tapers, spindle speeds, 40-way head, balanced pulleys, power feed table, motors and electrical controls.	
Rotary Machine, Combination	1
Saw, Hack, Power minimum cap. 6" x 6", swivel; vise; automatic lift; motor ½ HP; 3-phase; magnetic push button starter	
Shaper, Metal 12" to 15" stroke; specifications to be included according to need: cutting speeds, table travel — horizontal and vertical, tool head, drive unit, 1 lubricating system, drive unit including motor and switches, cross feed — power and hand, vise and shaper tools.	
Shear, Squaring foot capacity 16 gauge mild steel	1

XI. METALS — GENERAL FURNISHINGS

Bench, Arc welding with fire brick top; 2 station	1
Bench, Welding (gas)	1
Bench, Metalworking (2 place) laminated maple top; approx. size 4" x 24" x 2¼", angle iron edges; heavy gauge steel legs	4
Bench, Molding Steel construction; size approx. 30" x 60" x 32"H. Trough galvanized for damp sand storage; storage below for tools, etc.	1
Bench, Sheet metal (with stake plates) Top 60" x 40" x 2¼"; laminated maple, height 32"; angle iron edges, 3 shelves, with 2 stake plates 30" x 8"	1
Bench, Soldering Steel, transite covered top, 6' x 30"W x 32"H; steel storage cabinet below	1
Bench, Wall type top 100" x 24" x 2¼"T; laminated maple top; height 32"; bolted construction; steel legs	2
Furnace, Crucible maximum capacity number 16 crucible	1

XII. Power Mechanics — Hand Tools	Quantity

XII. POWER MECHANICS — HAND TOOLS

Adaptor, Socket for wrenches 1/2"-3/8" drive	2
Compressor, Piston ring (set) capacity 1 3/8"-7"	1
Compressor, Valve spring	1
Cutter, Tubing 1/8"-1" cap.	1
Flaring Tool (set) range 3/16"-5/8"	1
Flywheel Holder (for small gas engine)	1
Gauge, Cylinder pressure gauge range 0-300 p.s.i.	1
Gauge, Ignition (set)	1
Gauge, Spark plug	1
Gauge, Thickness ("feeler") minimum 6 leaf; ½" x 2½"; .0015-.015	2
Gear Puller	1
Hammer, Ball peen (16 oz.)	3
Pliers, Bent nose (6")	2
Pliers, Hose clamp, Radiator and gas line (8")	1
Pliers, Needle nose (6")	2
Pliers, Tru-arc (number 2)	1
Pliers, Vise-grip wrench (7")	2
Socket, Deep spark plug (13/16")	1
Socket, Deep spark plug (1 1/8")	1
Wrench, Allen key (hex) (set) set includes 11 standard size; no. ½-no. 12	2
Wrench, Combination box and open end (set) range of openings 3/8"-1"	1
Wrench, Ignition (set) size 15/64", 1/4", 9/32", 5/16", 11/32", 3/8"	1

XII. Power Mechanics — Hand Tools (cont.)	Quantity
Wrench, Open end (set) double end wrenches; sizes ¼"-1"	1
Wrench, Pipe (10")	1
Wrench, Pipe (18")	1
Wrench, Socket (3/8" drive) (set)	1
Wrench, Socket (½" drive) (set)	1
Wrench, Socket, Reversible ratchet handle (3/8" drive)	1
Wrench, Socket, Reversible ratchet handle (½" drive)	1
Wrench, Torque (3/8" drive)	1

XIII. POWER MECHANICS — MACHINES

Engine, Small (2-cycle)	1
Engine, Small (4-cycle)	1
Grinder, Valve (set)	1
Refacer, Valve (set)	1

XIV. POWER MECHANICS — GENERAL FURNISHINGS

Cabinet, Mechanics, Roller	1

XV. WOODWORKING — HAND TOOLS

Bit, Auger (set) sizes 4-16	1
Bit, Electrician's 18"L x 5/16"D	1
Bit, Expansive boring size from 7/8"-3"	1
Bit, Forstner (machine set) ½" shank; sizes 6, 8, 10, 12, 14, 16 in 16ths of an inch	1
Bit, Plug cutter (set) set of 5; sizes 3/8", 1/2", 5/8", 3/4", 1"	1
Bit, Screwdriver (set)	1
Brace, Ratchet (10")	2
Burnisher round tempered steel; 4½" blade	1

XV. Woodworking — Hand Tools (cont.)	Quantity
Chisel, Carving (set) set of 6 chisels and gauges; approx. 6" long	2
Chisel, Gouge, Inside (set) sizes 1/4", 3/8", 1/2", 3/4", 1"	1
Chisel, Socket firmer (set) set of 6; sizes 1/4", 3/8", 1/2", 5/8", 3/4", 1"	1
Chisel, Wood turning (set) overall length at least 17"	2
Clamp, Bar (36")	4
Clamp, Bar (48")	4
Clamp, Bar (60")	2
Clamp, Handscrew (number 3/0)	2
Clamp, Handscrew (number 0)	2
Clamp, Handscrew (number 1)	2
Clamp, Handscrew (number 2)	2
Clamp, Handscrew (number 3)	2
Countersink Bit (for brace) (set) size 5/8" and 3/4"	1
Drill, Hand (¼")	1
Drill, Hand (3/8")	1
Drill Stand, Fractional for twist drills; from 1/16"-1/2" by 64ths	1
Drill, Twist, Straight shank (fractional set) high speed; no. 2 Morse Taper Shank; 5/8"-1" by 8ths	1
Gauge, Auger bit for gauging hole depth	1
Gauge, Marking (double bar)	3
Hammer, Claw (7 oz.)	2
Hammer, Claw (13 oz.)	3
Hammer, Claw (16 oz.)	3
Jig, Dowelling with guides 3/16", 1/4", 5/16", 3/8", 7/16", 1/2"	1
Level (24" long)	1

XV. Woodworking — Hand Tools (cont.)	Quantity
Miter Box 26" x 4" back saw; 8¼ right angle capacity	1
Nail Set (1/16" tip)	3
Nipper, End cutting (6")	1
Oilstone, Carving tool slips (set)	1
Oilstone, Gouge slip	1
Oilstone, Slip	1
Plane, Block (1 5/8" cutter)	2
Plane, Jack (14"L)	2
Plane, Jointer (22"L)	1
Plane, Junior jack	4
Plane, Smoothing length 9"; blade width 1¾"	2
Rule, Maple (24")	6
Saw, Back (12")	2
Saw, Compass (set)	2
Saw, Coping (6½" long, end)	3
Saw, Hand, Crosscut (22"; 10 point)	1
Saw, Hand, Rip 26"; 5½ point, straight back	1
Scraper, Cabinet (2¾" blade)	2
Scraper, Hand approx. 3" x 5" steel blade	2
Spokeshave, Straight	1
Square, Try (8")	6
Stop, Bench	6
T Square (minimum size 24")	2

XVI. WOODWORKING — MACHINE

XVI. Woodworking — Machine	Quantity
Jointer (6")	1
Lathe, Wood turning 12" gap bed floor model with enclosed metal cabinet with 16½" capacity over gap and at least 38" between centers. Motor ¾HP, 60-cycle. 208V or 220V. 3-phase with mounted switch and overload protection. To include cup center, spur center, 3 face plates, 1-6" tool rest, 1-12" tool rest, 1 tool support base, 1 knock-out bar.	1
Router, Portable, Electric motor ½ or 7/8 HP	1
Saw, Band, Wood-cutting 14" floor model; motor ½HP, 60-cycle; 208V or 220V; 3-phase with magnetic switch and starter or 20" model with 1½ HP motor	1
Saw, Circular, Power 10" floor model; motor 1½HP, 60-cycle; 208V or 220V; 3-phase with magnetic switch and starter or 12" model with 5HP motor	1
Saw, Jig (scroll) 24"; metal stand, motor 1/3HP; 60-cycle AC; 115V with magnetic switch and starter	1
Saw, Radial-arm, Power 10" complete with stand, 2HP, 60-cycle, 208V or 220V, 3-phase, with magnetic switch and starter	1
Saw, Sabre (bayonet) portable; heavy duty	1
Surfacer (single surface planer) 12" x 5" cap.; floor model; motor 3HP, 50-cycle, 208V or 220V, 3-phase; with magnetic switch and starter and overload protection or 18" model; 20" cap.; floor model; motor 5HP; 60-cycle; 208V or 220V with switch and overload protection	1

XVII. GRAPHIC ARTS — HAND TOOLS

Bone Folder (1"W x 8"L)	3
Borders, Decorations, Miscellaneous	1
Can, Safety (1 quart)	2
Chases, Platen cast iron; size to fit print; press handle; type recommended	6
Composing Stick (6")	6
Composing Stick (10")	3
Cutter, Lead and slug	1

XVII. Graphic Arts — Hand Tools (cont.)	Quantity
Cutter, Linoleum (set) push type cutters; set of 5 with assorted cutter and handles	2
Cutter, Paper (24")	1
Fountain Pen (technical set)	1
Furniture, Wood, Fonts	1
Gauge, Line (12")	3
Gauge, Pin (sets)	6
Knife, Ink (square end; 8")	2
Knife, Stencil	2
Leads (2 point) (25 lb. pkg.)	1
Lettering Set character height 3/16"	1
Numbering Machine, Press 6 wheel	1
Pen Set	1
Pencil Pointer, Lead pencil	1
Planer, Type suggest 2 sizes: 1¾" x 3" x 1½" and 3¼" x 8" x 2½"	2
Punch, Paper	1
Quoin, Hispeed 3 and 9	12
Quoin Key, Hispeed	2
Reglets, Wood Font	1
Rule, Brass	1
Scale, Architect's	6
Silk Screen Unit printing frame; number 12 silk	1
Slugs (6 point) (25 lb. pkg.)	1
Spaces, Assorted fonts (6 point)	1
Spaces, Assorted fonts (8 point)	1
Spaces, Assorted fonts (10 point)	1
Spaces, Assorted fonts (12 point)	1

XVII. Graphic Arts — Hand Tools (cont.)	Quantity
Spaces, Assorted fonts (14 point)	1
Spaces, Assorted fonts (18 point)	1
Spaces, Assorted fonts (24 point)	1
Spaces, Assorted fonts (30 point)	1
Spaces, Assorted fonts (36 point)	1
Staple Remover	1
Triangle, 30 degrees - 60 degrees (8")	2
Triangle, 45 degrees (8")	2
T Square (minimum size 24")	2
Tweezers, Type 4½"; fine pointed	2
Type (assorted sizes and styles)	

XVIII. GRAPHIC ARTS — MACHINES

Planer, Type suggest 2 sizes: 1¾" x 3" x 1½" and 3¼" x 8" x 2½"	1
Press, Padding (bench model)	1
Press, Platen 12" x 18"; hand fed	1
Press, Platen, Hand lever (6" x 10")	1
Press, Proof	1
Press, Rubber stamp	1
Printmaker, Graphic arts 12" x 12" steel built	1
Stapler, Saddle (throat depth 8")	1

XIX. GRAPHIC ARTS — GENERAL FURNISHINGS

Cabinet, Proof press	1
Cabinet, Type, Double tier	1
Imposing Stone Table 27" x 39" (beginning); 31" x 39" (advanced); cast iron surface	1

LEVELS II, III, IV
DRAFTING

I. Audio-Visual Equipment	Introductory	Quantity	Advanced	Quantity
I. AUDIO-VISUAL EQUIPMENT				
Chalkboard Drafting Machine Horizontal rail 72"			X	1
Compass, Chalkboard 16" minimum length	X	1	X	1
Display Board aluminum frame, cork composition, 48" x 48" — 96" x 96"	X	1	X	1
Divider, Blackboard hardwood	X	1	X	1
Projection Box, Plastic three plastic hinged planes, 12" x 12"	X	1		
Projection Box, Plastic, Instructor's three plastic hinged planes, 12" x 12"			X	1
Projection Box, Plastic Student's three plastic hinged planes, 4" x 4"			X	1
Projector, Filmstrip (35mm) and slide (2" x 2")	X	1	X	1
Projector, Motion picture, Sound	X	1	X	1
Projector, Overhead with acetate roll	X	1	X	1
Protractor, Chalkboard 15" hardwood	X	1	X	1
Scale, Chalkboard (demonstration) minimum length 6'	X	1	X	1
Screen, Projection	X	1	X	1
Triangle, Chalkboard, 30 degrees-60 degrees 24", hardwood	X	1	X	1
Triangle, Chalkboard, 45 degrees hardwood	X	1	X	1

II. Instruments and Tools	Introductory	Quantity	Advanced	Quantity
II. INSTRUMENTS AND TOOLS				
Acv-Arc Ruler			X	1
Brush, Duster, Draftsman's 2½" bristles, 13" overall length	X	24	X	24
Chalkboard Drafting Machine			X	1
Compass and Divider (set)	X	24	X	24
Compass, Beam (24")	X	4	X	4
Compass, Drop bow (4")			X	1
Curve, Irregular (set)	X	1	X	1
Curve, Rule (adjustable)			X	1
Cutter, Paper (24")	X	1	X	1
Dispenser, Drafting tape	X	2	X	2
Divider, Proportional 7½" or larger			X	2
Eraser Shields sizes 2½" x 3¾" x .005	X	24	X	24
Fountain Pen (technical set) 7 sections, sizes 00, 0, 1, 2, 2½, 3, 4			X	6
Geometric Shapes (set)			X	1
Lettering Guide Line Instrument	X	24	X	24
Lettering Set			X	1
Oilstone, Arkansas wedged shape, fine grain	X	1	X	1
Pantograph, Drafting 21" hardwood, 7:25 ratio			X	1
Parallel Rules			X	1
Pen Holder 6" to 7" length			X	24
Pen Set			X	24

II. Instruments and Tools (cont.)	Introductory	Quantity	Advanced	Quantity
Pen, Speedball (set)			X	1
Pencil Pointer, Lead pencil	X	24	X	24
Pencil Pointer, Mechanical	X	1	X	1
Pencil Sharpener, Draftsman's	X	1	X	1
Pencil Sharpener, Standard	X	1	X	1
Protractor, Semi-circular	X	6	X	6
Repair Kit, Drafting instrument			X	1
Scale, Architect's 12" triangular	X	24	X	24
Scale, Decimal, Civil engineer's 12" triangular			X	12
Scale, Mechanical engineer's 12" triangular	X	6	X	12
Scale, Metric 12" triangular			X	1
Scissors (8")	X	1	X	1
Sign-maker Set			X	1
Straight Edge, Parallel ruling transparent plastic edging			X	12
Template, Architectural			X	12
Template, Electronic			X	6
Template, Isometric circle			X	6
Template, Isometric circle Large			X	6
Template, Large circle			X	24
Template, Nuts and bolts			X	5
Triangle, 30-60 degrees (8")			X	24
Triangle, 45 degrees (6")	X	24		
Triangle, 30-60 degrees (10" and 12")	X	24		
Triangle, 45 degrees (8")			X	24
Triangle, 45 degrees (12")			X	3

II. Instruments and Tools (cont.)	Introductory	Quantity	Advanced	Quantity
Triangle, Adjustable (10")			X	6
T Square minimum size 24"	X	24	X	24
III. MACHINES				
Acv-Arc Ruler			X	1
Chair, Teacher's welded steel construction, swivel, with casters	X	1	X	1
Desk, Teacher's 42" x 30" x 29", welded steel construction	X	1	X	1
Desk, Teacher's standing approx. 36" x 26" x 42"H, welded steel construction	X	1	X	1
File, Drafting to accomodate 36" x 48" drawing set			X	1
Frame, Printing to accomodate 14" x 22" drawing			X	1
Pan, Dust (12" steel)	X	1	X	1
Rack, Magazine magazine shelving, 60"H x 12"D x 36"L			X	1
Stool, Instructor's adjustable, swivel, thick foam rubber seat, 28"-34", tubular steel construction	X	1	X	1
Stool, Student's adjustable 18"-27" or 24"-33"	X	24	X	24
Table, Drafting overall size approx. 38" x 28" x 39", wood or metal, 6 drawers storage unit	X	24	X	24
Table, Overhead projector portable, 26"H	X	1	X	1
Table, Planning 72" x 30" x 30"H			X	1
Table, Tracing			X	1
Erasing, Machine, Elec.			X	1

III. Machines (cont.)	Introductory	Quantity	Advanced	Quantity
Machine, Drafting (18")			X	24
Machine, Drafting (24")			X	4
Machine, Reproduction dry type	X	1	X	1
Machine, Reproduction moist type width capacity 42"	X	1	X	1
Marking Tool, Electric	X	1	X	1
Parallel Rule (18")			X	1

IV. GENERAL FURNISHINGS

	Introductory	Quantity	Advanced	Quantity
Board Drafting 18" x 24"—beginning, 24" x 36" or 31" x 42"—advanced	X	24	X	24
Bookcase approx. 60"H x 10-12"D x 72"L three shelves, adjustable, wood or metal	X	1	X	1
Broom, Push 18" in length	X	2	X	2
Brush, Bench	X	12	X	12
Cabinet, Filing 4 drawers, 52"H x 15"W x 28½"D	X	1	X	1
Cabinet, Storage steel construction, adjustable shelves, 2 doors and locks	X	2	X	2

V. MISCELLANEOUS

	Introductory	Quantity	Advanced	Quantity
Caliper, Inside (6")			X	1
Caliper, Outside (6")			X	1
Die, Letter (set) 3/16", character height	X	1	X	1
Die, Number (set) 3/16", character height	X	1	X	1
Extension Cord heavy duty, grounded, 25'	X	1	X	1
Fire Extinguisher	X	1	X	1

V. Miscellaneous (cont.)	Introductory	Quantity	Advanced	Quantity
First Aid Kit	X	1	X	1
Gauge, Screw pitch			X	1
Gauge, Wire and sheet metal (American) sizes 0-36	X	1	X	1
Gauge, Wire and sheet metal (U.S.S.) sizes 0-36	X	1	X	1
Hammer, Claw (16 oz.)	X	1	X	1
Knife, Carving (set)			X	6
Micrometer, Outside (1")			X	1
Pliers, Straight nose 8", combination	X	1	X	1
Punch, Paper adjustable, 1 to 4 holes	X	1	X	1
Rule, Flexible, Steel tape (12')			X	1
Rule, Flexible, Steel tape (100')			X	1
Screwdriver, Phillips (set) point numbers 1, 2, 3	X	1	X	1
Screwdriver, Standard bit Round Blade, set 3/16", 1/4", 5/16", 3/8", 1/2"	X	1	X	1
Screwdriver, Standard bit Square Blade, 6"	X	1	X	1
Square, Combination set (with protractor and center head) 12" rule			X	1
Stapler, Hand	X	1	X	1
T Bevel, Sliding (6")			X	1

LEVELS II, III, IV
ELECTRICITY/ELECTRONICS

I. Small Tools and Equipment	Introductory	Quantity	Advanced	Quantity
I. SMALL TOOLS AND EQUIPMENT				
Alignment Tool (set)	X	2	X	2
Bit, Auger (set) sizes 4-16	X	1	X	1
Bit, Screwdriver (set) square tang, ¼", 5/16", 3/8", ½"	X	2	X	2
Bit, Speed (set) sizes ¼", 3/8", ½", 5/8", ¾", 1"	X	2	X	2
Brace, Ratchet (10")	X	1	X	1
Brake, Box and pan 24", capacity 16 ga. depth of box 3"	X	1	X	1
Bulb Type Solder Remover with Teflon Tip	X	1	X	4
Chisel, Cold (set) ¼", 3/8", ½", ¾"	X	1	X	1
Coil Winder	X	1	X	1
Countersink, High speed steel ¼" shank, ½" size	X	1	X	1
Crimping Tool	X	2	X	2
Die, Letter (set) (3/16")	X	1	X	1
Die, Number (set) (3/16")	X	1	X	1
Divider, Wing (6")	X	1	X	1
Drill, Electric Portable (¼")	X	1	X	1
Drill, Hand (¼")	X	1	X	1
Drill Stand, Franctional 1/16"-1/2" by 64ths	X	1	X	1
Drill, Twist (letter set) high speed steel, straight shank	X	1	X	1
Drill, Twist (number set) high speed steel, straight shank, number 1-60	X	1	X	1

I. Small Tools and Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Drill, Twist, Straight shank (Fractional Set) high speed steel, 1/16"-1/2" by 64ths	X	1	X	1
Extension cord 25', heavy duty, grounded	X	2	X	2
Files				
6", mill (flat), second cut	X	4	X	4
6", half-round, second cut	X	4	X	4
File Card and Brush	X	6	X	6
File, Jeweler's (set) assorted shapes, 4"-6"	X	1	X	1
File, Needle (set) set of 12 — 5½"L	X	1	X	1
Gauge, Auger bit	X	1	X	1
Gauge, Screw pitch	X	1	X	1
Gauge, Thickness ("feeler") minimum 6 leaf, ½" x 2½" x .0015" — .015"	X	1	X	1
Gauge, Wire and sheet metal (American) sizes 0-36	X	1	X	1
Gauge, Wire and sheet metal (U.S.S.) sizes 0-36	X	1	X	1
Goggles (spectacles), Clear observation	X	12	X	12
Grinder, Pedestal steel size 1" x 7" — 1 fine grit — 1 coarse wheel, tool rests, ½HP, 60-cycle, 110V	X	1	X	1
Hammer, Ball peen (12 oz.)	X	6	X	6
Hammer, Ball peen (16 oz.)	X	6	X	6
Hammer, Claw (16 oz.)	X	6	X	6
Knife, Electrician's	X	6	X	6

I. Small Tools and Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Light, Extension			X	2
Magnet, Bar minimum size = ¼" x ½" x 3"	X	24	X	24
Nibbler, Hand operated capacity 18" steel	X	2	X	2
Oiler, Bench ½ pint size, 5" steel spout	X	1	X	1
Oilstone, Combination, India coarse and fine grits, 8" x 2" x 1"	X	2	X	2
Pliers, Combination (6")	X	12	X	12
Pliers, Duckbill (8")	X	6	X	6
Pliers, Diagonal cutting (6")	X	12	X	12
Pliers, Needle nose (6")	X	12	X	12
Pliers, Side-cutting (6")	X	12	X	12
Pliers, Vise-grip wrench (7")	X	3	X	3
Press, Drill 15" cap. variable speed, number 2 Morse Taper in spindle, floor model, ½HP, magnetic switch	X	1	X	1
Punch, Center (set) 4"L, 1/16"-1/2" by 32nds	X	2	X	2
Punch, Chassis (round set) 2 piece dies, 7/8", 3/4", 1", 1 1/8"	X	1	X	1
Punch, Chassis (square set) 2 piece dies, ½", ¾", 1"	X	1	X	1
Punch, Pin (set) 4"L, 1/16-1/2" by 32nds	X	2	X	2
Reamer, Electrician's hand 1/8" tip, tapered, 5"L graduated to 1/16"	X	1	X	1
Rule, Steel (12") graduated to 1/16"	X	6	X	6
Saw, Coping 6½" frame	X	1	X	1

I. Small Tools and Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Saw, Hack (hand) adjustable to receive 9" to 12" blade	X	4	X	4
Saw, Hand, Crosscut 22", 10 point	X	1	X	1
Scissors (8")	X	1	X	1
Screwdriver, Insulated (set) regular blades, 3/16" by 9/32" with 4", 6", and 8" shafts	X	12	X	12
Screwdriver, Phillips (set) set with points no. 1, no. 2, no. 3	X	4	X	4
Screwdriver, Retaining type 3/16" blade	X	2	X	2
Shear, Squaring, Foot operated capacity mild steel 16 ga.			X	1
Shield, Face	X	6	X	6
Snip, Aviation (left) 10"L	X	2	X	2
Snip, Aviation (right) 10"L	X	2	X	2
Snips, Tinner's, Straight (number 8)	X	3	X	3
Soldering Copper, Electric (60W) ¼" copper tip	X	6		
Soldering Copper, Electric pencil 30W, 7" slim handle	X	6	X	12
Fittings for Transistors and I.C.	X	1	X	4
Soldering Gun, Electric dual heat, 240/325W, spot light	X	4	X	4
Square, Combination 12" rule	X	3	X	3
Square, Steel framing 12" x 24"	X	1	X	1
Square, Try (6")			X	6

I. Small Tools and Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Tap and Die, NC (U.S. standard) (set) ¼-20, 5/16-18, 3/8-16, 7/16-14, ½-13, complete with die stock and tap wrench	X	1	X	1
Tap and Die, NF (S.A.E.) (set) ¼-28, 5/16-24, 3/8-24, 7/16-20, ½-20	X	1	X	1
Tap and Die, Pipe (set) pipe sizes 1/8”, ½”, ¾”, 1”; tap, die and reamer	X	1	X	1
Welder, spot	X	1	X	1
Printed Circuit Board Vise	X	24	X	24
Wrench, Adjustable end (6”)	X	4	X	4
Wrench, Allen key (hex) (set) no. 1½, no. 12	X	2	X	2
Wrench, Nutdriver (set) set of 8 drivers, sizes 3/6”, ¼”, 9/32”, 5/16”, 11/32”, 3/8”, 7/16”, ½”	X	2	X	2
Wrench, Open end (set) sizes ¼”-1”	X	1	X	1
Wrench, Socket (3/8” drive) (set) 10 piece set, 7 standard sockets, sizes 3/8”-3/4” by 16ths	X	1	X	1
II. POWER SUPPLY				
Power Supply, Variable output 0-20V AC and DC at 10 amperes	X	12		
Power Supply, Variable output, Filtered 0-300V DC at 100 ma.			X	12
Signal Generator/Audio Freq.	X	12	X	12
Signal Generator/Radio Freq.	X	1	X	12

III. Test Equipment	Introductory	Quantity	Advanced	Quantity
III. TEST EQUIPMENT				
Capacitor Substitution Box 100 mmf. - .111 mmd., 350WVDC	X	1	X	1
Resistance Substitution Box	X	1	X	1
Oscilloscope (5” screen)	X	12	X	12
Signal Tracer	X	2	X	2
Tester, Transistor/ In and Out of Circuit	X	1	X	12
Tester, Tube	X	1	X	1
IV. METERING EQUIPMENT				
Meter, Ammeter (AC) range 0-25 amps.	X	1	X	1
Meter, Battery tester	X	1	X	1
Meter, Galvanometer 500-0-500 micro amperes			X	1
Meter, Grip dip 400 KC — 250 MC			X	1
Meter, Volt-ohm (multi-range)	X	12	X	12
Meter, VTVM	X	12	X	12
V. GENERAL FURNISHINGS				
Bench, Island-double-face 6’ x 48”, 12 steel lockers, 6 cabinets	X	6	X	6
Bench, Electric demonstration 6’ x 30” cabinet storage, 0-120V AC and DC outlets			X	1
Bookcase approximate 60”H x 10-12”D x 72”L, 3 adjustable shelves, wood or metal	X	1	X	1
Broom, Push 18” in length	X	3	X	3

V. General Furnishings (cont.)	Introductory	Quantity	Advanced	Quantity
Cabinet, Filing 4 drawer, 52"H x 15"W x 28½"D	X	1	X	1
Cabinet, Instrument storage 30"W x 18"D x 72"H, with adjustable shelves and lock	X	2	X	2
Cabinet, Parts storage metal, 100 drawers	X	1	X	1
Cabinet, Tool storage approximate 62"W x 22"D x 84"H	X	1	X	1
Chair, Teacher's welded steel construction, swivel, with casters	X	1	X	1
Compressor, Air 120 p.s.i., 60 gallons, 1½ HP motor	X	1	X	1
Desk, Teacher's approx. 42" x 30" x 29" welded steel construction	X	1	X	1

V. General Furnishings (cont.)	Introductory	Quantity	Advanced	Quantity
Fire Blanket	X	1	X	1
Fire Extinguisher — CO_2	X	2	X	2
First Aid Kit	X	1	X	1
Pan, Dust (12" steel)	X	1	X	1
Pencil Sharpener, Standard	X	1	X	1
Projector, Filmstrip (35mm) and slide (2" x 2")	X	1	X	1
Projector, Motion picture, Sound	X	1	X	1
Projector, Overhead	X	1	X	1
Screen, Projection 60" x 60"	X	1	X	1
Student Fundamental Units	X	12	X	12
Table, Overhead projector portable, 26" high	X	1	X	1

LEVELS II, III, IV
GRAPHIC ARTS

I. Basic Equipment	Introductory	Quantity	Advanced	Quantity
I. BASIC EQUIPMENT				
Airbrush			X	1
Binding Unit, Plastics length 12"; ring binder capacity ¼"-½"D	X	1	X	1
Block, Proofing 3¼" x 8" x 2½", maple wood	X	2	X	2
Boards, Pressing ¾" x 9" x 12", hard maple	X	4	X	4
Camera, Copying horizontal, dark room type; process camera; maximum film 16" x 20"			X	1
Camera, Range finder (35mm)	X	1	X	1
Camera (35mm), Single lens reflex	X	1	X	1
Camera, Reflex, Twin lens	X	2	X	2
Cutter, Lead and slug	X	1	X	1
Cutter, Paper (24")	X	1	X	1
Cutter, Round corner pedestal model, foot operated, 2½" capacity	X	1	X	1
Densitometer, Photo			X	1
Drill, Electric, Portable (¼")	X	1	X	1
Dryer, Print rotary type; constant temperature; 12" x 18"; chrome plated surface	X	1	X	1
Duplicating Machine, Spirit			X	1
Duplicating Machine, Stencil			X	1

I. Basic Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Enlarger, Photographic condensor motor for negatives; size 4" x 5" and smaller	X	1	X	2
Exposure Frame 14" x 19" cap.			X	1
Ferrotype Plate chrome plated 10" x 14"	X	4	X	4
Filter, Photo (set)			X	1
Folding Machine paper size: 2¼" x 4¼-9½" x 15"			X	1
Glue Pot 1 quart	X	1	X	1
Imposing Stone Table 27" x 39" (beginning); 31" x 39" (advanced), cast iron surface	X	1	X	1
Jogger, paper 14", 20", 110V			X	1
Meter, Light miters 45; square ends of rules; ga. width of 63 pica	X	1	X	1
Mitering Machine miters 45; square ends of rules; ga. width of 63 pica	X	1	X	1
Numbering Machine, Cleaner box 6 wheel machine, 5 movements	X	1	X	1
Numbering Machine, Hand 6 wheel machine, 5 movements	X	1	X	1
Numbering Machine, Press 6 wheel	X	2	X	2
Pad Counter stabbing type; 3" adjustable for measuring equal size pads	X	1	X	1

I. Basic Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Perforator bench models; 19" cap.			X	1
Planer, Type suggest 2 sizes: 1¾" x 3" x 1½" and 3¼" x 8" x 2½"	X	4	X	4
Plate-maker approx. 24" cap. with flip top	X	1	X	1
Press, Copying 11" x 16" cap.	X	1	X	1
Press, Hot stamping 1" type holder	X	1	X	1
Press, Offset 11" x 15", 3 cylinder	X	1	X	1
Press, Padding bench model	X	1	X	1
Press, Platen 12" x 18", hand fed	X	1	X	1
Press, Platen, Automatic feed 10" x 15"			X	1
Press, Platen, Hand lever 6" x 10"	X	2	X	2
Press, Proof	X	1	X	1
Press, Proof, Reproduction hand operated			X	1
Press, Rubber stamp	X	1	X	1
Printer, Contact beginning — 35mm; advanced — adjustable margins to 8" x 8"	X	1	X	1
Printmaker, Graphic arts 12" x 12" steel bed	X	1	X	1
Projector, Filmstrip (35mm) and slide (2" x 2")	X	1	X	1
Projector, Motion picture, Sound	X	1	X	1
Projector, Overhead	X	1	X	1

I. Basic Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Punch, Paper	X	1	X	1
Quoin, Hi-speed 3" and 9"	X	48	X	48
Quoin Key, Hi-speed	X	4	X	4
Silk Screen Unit printing frames number 12 silk	X	2	X	2
Sinks, Developing temperature control; accomodates 3-20" x 24" trays	X	1	X	1
Sinks, Platemaking inside dimensions 29" x 48" x 8"D	X	1	X	1
Stapler, Saddle throat depth 8"	X	1	X	1
String Holder, Cone 2½ lb. cord	X	1	X	1
Tanks, Film development	X	5	X	5
Thermometer, Photographic	X	2	X	2
Timer, Photographic (electric)	X	2	X	2
Timer, Photographic (spring wound)	X	2	X	2
Tray, Photographic	X	12	X	12
Trimmer, Paper adjustable; 24" x 24" table	X	1	X	1
Truck, Bindery			X	1
Type, (assorted sizes and styles)				
Typesetter, Linecasting			X	1
Typesetter, Photon headsetter			X	1
Typewriter, Electric			X	1
Typewriter, Standard	X	1		

I. Basic Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Vacuum Printing Frame 17" x 21" working area; 110V, 60-cycle motor gauge			X	1
II. HAND TOOLS AND MISCELLANEOUS SUPPLIES				
Apron, Rubber	X	2	X	2
Awl, Bookbinder's detachable sharp steel point; 3"L	X	2	X	2
Bone Folder 1"W x 8"L	X	8	X	8
Brayer, Block printing 4" width	X	2	X	2
Brush, Flat padding 1½"W	X	2	X	2
Brush, Bookbinder's 1 or 1½"D	X	2	X	2
Brush, Opaque sizes 00 and 1	X	6	X	6
Brush, Type approx. size 2½" x 5"			X	2
Cards, Alphabet (set) size 12" to 42 point; approx. 125 cards with about 75 popular type faces	X	2	X	2
Chases, Platen cast iron; sizes to fit platen press handle in type recommended	X	12	X	12
Composing Stick (6")	X	24	X	24
Composing Stick (10")	X	6	X	6
Composing Stick (12")	X	2	X	2
Composing Stick (15")	X	1	X	1
Composing Stick, Micrometer knee (10")	X	1	X	1
Cutter, Linoleum (set) push-type cutters; set of 5; assorted cutters and handles	X	6	X	6

II. Hand Tools and Miscellaneous Supplies (cont.)	Introductory	Quantity	Advanced	Quantity
Die, Letter (set) 3/16" character height	X	1	X	1
Die, Number (set) 3/16" character height	X	1	X	1
Dispenser, Cellophane tape	X	3	X	3
Dispenser, Gummed paper	X	1	X	1
Drill, Hand (¼")	X	1	X	1
Drill, Hand (3/8")	X	1	X	1
Drill Stand, Fractional for twist drills from 1/16"-1/2" by 64ths	X	1	X	1
Drill, Twist, Straight shank (Fractional set) high speed steel by 64ths from 1/16" to 1/2"	X	1	X	1
File Card and Brush 9½"L, brush 1½" x 5"	X	1	X	1
Furniture, Wood, Fonts	X	4	X	4
Galley (10" x 16")			X	6
Galley (8¼" x 13")			X	100
Gauge, Auger bit 1 gauging hole depth	X	1	X	1
Gauge, Line (12")	X	12	X	12
Gauge, Line (18")	X	6	X	6
Gauge, Pin (sets)	X	6	X	6
Gauge, Type high standard for letter press printing (1918")	X	1	X	1
Gauge, Wire and sheet metal (American) sizes 0-36	X	1	X	1
Gauge, Wire and sheet metal (U.S.S.) sizes 0-36	X	1	X	1
Gloves, Thick rubber	X	2	X	2

II. Hand Tools and Miscellaneous Supplies (cont.)	Introductory	Quantity	Advanced	Quantity
Graduate, Darkroom conical type; 16 oz. capacity	X	6	X	6
Grease Gun	X	1	X	1
Hammer, Bookbinder’s backing 1 lb.; 12 oz. head; wooden handle	X	2	X	2
Hammer, Claw (16 oz.)	X	1	X	1
Knife, Ink square end, 8”	X	12	X	12
Knife, Make ready and stripping number 12; “Exacto”	X	12	X	12
Knife, Padding round end	X	2	X	2
Light, Darkroom	X	4	X	4
Light, Flood (10”)	X	4	X	4
Locks, Magnetic galley	X	25	X	25
Magnifiers etchers type; 10X	X	4	X	4
Mallet, Rawhide 100 oz.	X	2	X	2
Marker, Felt-tip, Color (set)	X	6	X	6
Needle, Binding	X	24	X	24
Oiler, Bench 1/3 or 1/2 pt. size; 5” straight spout	X	4	X	4
Oiler, Pump (5 oz.)	X	4	X	4
Oilstone, Combination, India coarse grit and fine; 8” x 1” x 2”	X	1	X	1
Oilstone, Combination, Silicon carbide coarse and fine grit; 8” x 2” x 1”	X	1	X	1
Pliers, Combination (6”)	X	2	X	2
Pliers, Vise-grip wrench (7”)	X	2	X	2

II. Hand Tools and Miscellaneous Supplies (cont.)	Introductory	Quantity	Advanced	Quantity
Rule, Make-up	X	12	X	12
Saw, Back (12”)	X	1	X	1
Saw, Printer’s trim	X	1	X	1
Scissors (8”)	X	6	X	6
Screens, Halftone, Contact	X	6	X	6
Screwdriver, Standard bit (round blade) (set) set of 5; blade widths 3/16”, 1/4”, 5/16”, 3/8”, 1/2”	X	6	X	6
Siphon, Photo	X	1	X	1
Spaces, Assorted fonts (10 point)				
Spaces, Assorted fonts (12 point)				
Spaces, Assorted fonts (18 point)				
Square, Steel framing 12” x 24”	X	1	X	1
Stapler, Hand 8½”; throat depth 4”	X	1	X	1
Triangle, 30 degrees- 60 degrees (8”)	X	8	X	8
Triangle, 45 degrees (6”) stainless steel; solid center with lifting knob	X	8	X	8
T Square minimum size 24”	X	4	X	4
Tweezers, Type 4½”, fine point	X	12	X	12
Wrench, Adjustable end (6”)	X	1	X	1
Wrench, Socket (3/8” drive) (set) 10 piece set; 7 standard sockets; 3/8”-3/4” by 16ths	X	1	X	1

II. Hand Tools and Miscellaneous Supplies (cont.)	Introductory	Quantity	Advanced	Quantity
Wrench, Socket (½" drive) (set) 9 piece set; 7 standard sockets; sizes 3/8"-3/4" by 16ths	X	1	X	1
III. GENERAL FURNISHINGS				
Bench, Bookbinding (unit) top 2" thick plastic laminated surface; complete with steel shelf and 2 stacking steel drawers; 72"L x 34"W x 34"H	X	1	X	1
Bench, Demonstration 1¾" x 28" x 6" maple top, lock, casters, double door cabinet			X	1
Bookcase approx. 60"H x 10-12"D x 72"L, 3 adjustable shelves, wood or metal	X	1	X	1
Broom, Push 18" in length	X	3	X	3
Brush, Bench	X	12	X	12
Cabinet, Drying rack steel construction with reinforced top; to include 14 dry racks 20" x 28½" x 1/8"	X	1	X	1
Cabinet, Filing 4 drawers, 52"H x 15"W, 28½"D	X	1	X	1
Cabinet, Film cutter steel construction; 4 drawers to accomodate 20" x 24" films			X	1
Cabinet, Galley galley sizes 8¾" x 13" or 10" x 16"	X	2	X	2
Cabinet, Ink and roller 30"W x 25"D x 40"H	X	1	X	1
Cabinet, Plate filing 14"W x 24"D x 25½"H steel mounted on 4 ball bearing wheels	X	1	X	1

III. General Furnishings (cont.)	Introductory	Quantity	Advanced	Quantity
Cabinet, Quarter case 10¾"W x 18¼"D x 38¼"H; steel construction, cap. 20 quarter size cases	X	1	X	1
Cabinet, Storage 76"H x 36"W x 18½"D; steel construction; lock and key provided	X	1	X	1
Cabinet, Type, Single tier steel construction; school type; floor space 32¼" x 42½"; height of working space 41"	X	2	X	4
Can, Oily waste 10 gallon capacity	X	2	X	2
Can, Safety (1 qt.)	X	2	X	2
Can, Safety (1 gal.)	X	2	X	2
Can, Safety (5 gal.)	X	1	X	1
Chair, Teacher's welded steel construction, swivel, with casters	X	1	X	1
Compressor, Air 120 p.s.i., 60 gal. in tank, 1½HP motor	X	1	X	1
Container, Benzene (1 pt.)	X	4	X	4
Container, Benzene (1 gal.)	X	2	X	2
Container, Benzene (5 gal.)	X	1	X	1
Desk, Teacher's approx. 72" x 30" x 29", welded steel construction	X	1	X	1
Fire Blanket	X	1	X	1
Fire Extinguisher	X	3	X	3
First Aid Kit	X	1	X	1
Goggles (spectacles), Clear observation	X	6	X	6
Pan, Dust (12" steel)	X	1	X	1
Pencil Sharpener, Standard	X	1	X	1

III. General Furnishings (cont.)	Introductory	Quantity	Advanced	Quantity
Rack, Roll, Tympan 18", tension bar with bracket	X	1	X	1
Rack, Roll, Wrapping paper 24", tension bar with bracket	X	1	X	1
Screen, Projection 60" x 60"	X	1	X	1
Shield, Face	X	3	X	3
Table, General purpose hardwood top; size 30" x 5-6'; cabinet storage below, 33" high	X	3	X	3
Table, Opaquing (beginning) 10" x 25"; (advanced) 24" x 36"	X	4	X	4
Table, Overhead projector	X	1	X	1
Table, Pilot press 24" x 48" x 31"	X	2	X	2
Table, Typewriter	X	1	X	1

LEVELS II, III, IV
CERAMICS

I. Raw Material Preparation and Storage	Introductory	Quantity	Advanced	Quantity
I. RAW MATERIAL PREPARATION AND STORAGE				
Box, Clay storage, Portable metal lined with casters	X	1	X	1
Cabinet, Damp-proof size 18"D x 26"L x 31"H	X	2	X	1
Filter Press (laboratory model)			X	1
Muller Mixer Cast aluminum drum, 13¼"D x 16¾"; motor 1/3HP; 115 volts; single phase	X	1	X	1
Pug Mill, Extrusion Table model; 40"L x 8 7/8"W x 9½"H; motor 1/3HP; 115V; single-phase	X	1		
Pug Mill, Laboratory model tub size 9" x 4'			X	1
Pug Mill, Studio model 58" x 30" x 2", 1½HP motor			X	1
Pug Mill, Vertical 12", 3HP motor	X	1	X	1
Pulverizer, Laboratory model			X	1
Storage Unit, Clay 24" x 24" x 28"	X	1	X	2
Wedging Boards 22" x 15" x 14" high or 12" x 15" x 2"T	X	1		
Wedging Table	X	1	X	1
II. MATERIAL FORMING				
Banding Wheel, Potter's bench				

II. Material Forming (cont.)	Introductory	Quantity	Advanced	Quantity
Banding Wheel, Potter's bench	X	6	X	12
Bench, Marble slab	X	1	X	1
Blunger (¼HP motor)	X	1	X	1
Dry Press table model; overall 15"H x 9"D x 7½"W	X	1	X	1
Extrusion Machine, Auger type	X	1	X	1
Jigger, Electric (industrial model) variable speed, ¾HP motor	X	1	X	1
Knife, Mold maker's blade length 4¾"	X	6	X	6
Mixer, Slow speed (portable) ¼HP motor	X	1	X	1
Modeling Tool (set) kit of 10 tools	X	6	X	6
Plaster Working Tool average length 7", 6 tools per set	X	6	X	6
Potter's Wheel, Electric ½HP motor, table 24" x 30"	X	1	X	2
Potter's Wheel, Kick 28" diameter, seated type	X	1	X	2
Potter's Wheel, Side-kick 14" aluminum wheel head, standing type	X	1	X	2
Table, Casting 8' x 2' x 32"H, Top 1" wood	X	1	X	1
Tank, Agitated storage tank size 42" x 42", 1HP motor, approx. 240 gals.	X	1	X	1

II. Material Forming (cont.)	Introductory	Quantity	Advanced	Quantity
Throwing Ribs, Wooden (set)	X	6	X	6
Wheel Turning Tool (set) set of six in 9½" lengths	X	1	X	1
III. GLAZING				
Ball Mill, Roller type 2 gallon size; ¼ to 1/3HP motor	X	1	X	2
Cabinet, Glaze and library 12"D x 36"W x 13½'W	X	1	X	1
Compressor, Air 60 gallon tank, 1½HP motor	X	1	X	1
Graduate, Cylinder (100cc)	X	3	X	3
Graduate, Cylinder (500cc)	X	3	X	3
Jars, Grinding 8 sizes, ½ to 6½ gallons	X	3	X	3
Mortar and Pestle	X	6	X	6
Scale, Laboratory up to 100 grams	X	1	X	1
Scale, Triple beam 310 grams capacity	X	1	X	1
Seive, Test laboratory 8"D, mesh sizes 30 to 120	X	6	X	6
Spray Booth, Dry 3'6"W x 6'1"H, working depth 1'11", ¼HP fan motor	X	1	X	1
Spray Gun, Touch-up	X	1	X	1
IV. ENAMELING				
Atomizer	X	1	X	1
Firing Racks three sizes: 3" x 3", 6" x 6", 12" x 12"	X	3	X	3

IV. Enameling (cont.)	Introductory	Quantity	Advanced	Quantity
Fork, Firing 20" length	X	1	X	1
Kiln, Enameling 110 volt, 10 amps., interior 4" x 8½" x 8'	X	1	X	1
Sifter	X	2	X	3
Trivets	X	3	X	3
V. FIRING				
Furnace, Crucible maximum cap. no. 16 crucible; temp. range 1200-2300 degrees F.	X	1	X	1
Kiln Cut-Off, Automatic (heat control device) Temp. to 2300 degrees F.	X	1	X	1
Kiln, Electric fire chamber 6½" x 7" x 4"; temp. 3000 degrees F.; 110 volts; 14.5 amps.	X	1	X	1
Kiln, Front loading 18" x 18" x 19" chamber; temp. to 2000 degrees F.; 208 or 220-230V AC	X	1	X	1
Kiln, Gas 32" x 23" x 46" chamber; temp. to 2500 degrees F.; automatic cut off control	X	1	X	1
Kiln, Starter	X	1	X	1
Kiln, Top loading 17" x 17" x 18" chamber; electric; temp. to 2300 degrees F.	X	1	X	1
Pyrometer, Optical	X	1	X	1
Pyrometer, Portable 30" thermocouple; range to 2500 degrees F.	X	1	X	1
Pyrometer, Radiation temp. 1000 degrees F.; thermo-electric principles	X	1	X	1

VI. Decoration — Finishing	Introductory	Quantity	Advanced	Quantity
VI. DECORATION — FINISHING				
Airbrush	X	1	X	1
Cabinet, Drying base height 18"D x 36"L x 31"H	X	1	X	1
Knife, Fettling	X	1	X	1
Scraper, Flexible	X	1	X	1
Scraper, Rigid	X	1	X	1
Ware Truck rubber tiered, swivel, 8 shelves, 22" x 28"	X	1	X	1
VII. CAST STONE				
Mason's Tools, Cement (set)	X	1	X	1
Mortar Box	X	1	X	1
VIII. GENERAL FURNISHINGS AND HAND TOOLS				
Bench, Woodworking (4 place) 2½" x 54" x 64", hard maple top mounted on two 36"W x 21"D x 31"H base units, wood or metal	X	1	X	1
Bookcase approx. 60"H x 10-12"D x 72"L, 3 shelves adjust- able, wood or metal	X	1	X	1
Broom, Push 18" in length	X	3	X	3
Brush, Bench	X	6	X	6
Gauge, Wire and sheet metal (U.S.S.) sizes 0-36	X	1	X	1
Gauge, Wire and sheet metal (American) sizes 0-36	X	1	X	1
Goggles (spectacles), Clear observation	X	12	X	12

VIII. General Furnishings and Hand Tools (cont.)	Introductory	Quantity	Advanced	Quantity
Grinder-Buffer, Bench, Combination ¼HP, 1725 RPM, 115V AC, hydraulic hand truck	X	1	X	1
Lift, Pallet	X	1	X	1
Molds, Ceramics, Assorted	X	6	X	6
Pan, Dust 12" steel	X	1	X	1
Pencil Sharpener, Standard	X	1	X	1
Pliers, Combination (6")	X	2	X	2
Press, Drill (15") variable speed number 2, Morse Taper, floor model, ½HP motor, magnetic switch and starter	X	1	X	1
Projector, Filmstrip (35mm) and slide (2" x 2")	X	1	X	1
Projector, Motion picture, Sound (16mm)	X	1	X	1
Cabinet, Filing four drawers, 52"H x 15"W x 28½"D	X	1	X	1
Can, Safety (1 qt.)	X	2	X	2
Can, Safety (1 gal.)	X	2	X	2
Chair, Teacher's welded steel construction, swivel with casters	X	1	X	1
Crusher, Jaw (laboratory model)			X	1
Desk, Teacher's approx. 42" x 30" x 29", welded steel construction	X	1	X	1
Drill, Hand (3/8")	X	1	X	1
Finishing Rubber size number 1 or number 2	X	1	X	1
Fire Blanket	X	1	X	1
Fire Extinguisher	X	3	X	3

VIII. General Furnishings and Hand Tools (cont.)	Introductory	Quantity	Advanced	Quantity
First Aid Kit	X	1	X	1
Gauge, Auger bit	X	1	X	1
Projector, Overhead	X	1	X	1
Pump, Slip, Duplex			X	1
Screen, Projection 60" x 60"	X	1	X	1
Shield, Face	X	6	X	6

VIII. General Furnishings and Hand Tools (cont.)	Introductory	Quantity	Advanced	Quantity
Sponge, Elephant ear shape	X	3	X	6
Sponge, Sheep wool	X	3	X	6
Spray Booth, Ceramic 24" x 24" x 28", with 10" electric exhaust fan			X	1
Table, Overhead projector portable, 26" high	X	1	X	1

LEVELS II, III, IV
PLASTICS

I. Basic Plastics Equipment	Introductory	Quantity	Advanced	Quantity
I. BASIC PLASTICS EQUIPMENT				
Autoclave steam pressure regulated to 50 p.s.i.; cap. 2 gal.	X	1	X	1
Extruder, Medium cap. 1"-1½"; 208V or 220V; 3-phase operation	X	1	X	1
Extruder, Large maximum cap. 2"; 208 or 220V; 3-phase			X	1
Extruder, Small cap. ¾"; 110V or 208 or 220V; single-phase operation	X	1	X	1
Molder, Blow 6" x 12" platen; cylinder approx. 2½" bore, 2" stock			X	1
Molder, Rotational variable speed drive, 2-15 RPM; motor ¼HP, 110V with reversing switch; approx. 15" diameter			X	1
Molding Press, Compression (large) cap. 45 ton or more; 208 or 220V; 3-phase; electrical heated platen; size approx. 18" x 18"; piston stock 5"	X	1	X	1
Molding Press, Compression (medium) cap. 50 ton; 208 or 220V; 3-phase; electrical heated platen plate; size 12" x 12" minimum; stroke 5"	X	1	X	1
Molding Press, Compression (small) cap. 20-25 tons; 208 or 220V, 3-phase; electrical heated platen; size 6" x 6" minimum	X	1	X	1

I. Basic Plastics Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Molding Press, Injection (large) cap. 3 oz. of styrene heaters; 208 or 220V, 3-phase; motor operated hydraulic system			X	1
Molding Press, Injection (medium) cap. 1½ oz. of stryene, 208 or 220V, 3-phase; motor operated pneumatic or hydraulic system	X	1	X	1
Molding Press, Injection (small) cap. ¼ oz.-¾ of styrene heaters; 110V; single-phase; hand operated, mechanic or pneumatic	X	1		
Molding Press, Transfer (large) cap. 75 ton or more on clamp; 208 or 220V; 3-phase; heated platen, size 18" x 18" minimum			X	1
Molding Press, Transfer (medium) cap. approx. 50 ton on clamp; 208 or 220V; 3-phase; heated platen; hand or motor operated; platen size 12" x 12"			X	1
Oven approx. 12"W x 10"H x 10"D; 0-550 degrees F.; 208 or 220V or 110V	X	1	X	1
Pre-Expander, Polystyrene steam or electrical 208 or 220V; 3-phase			X	1
Scrape Granulator			X	1
Spray Gun (all-materials) steam or electric	X	1	X	1
Spray Unit, Reinforced plastics			X	1

I. Basic Plastics Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Thermoforming Press, Vacuum (large) approx. set size 24" x 36"; 208 or 220V; 3-phase heater	X	1	X	1
Thermoforming Press, Vacuum (medium) approx. maximum wet size 8" x 8"; 110V heater; manual			X	1
Thermoforming Press, Vacuum (small) 2-6" x 1" muslin wheels; motor 1/3HP; 1725 RPM; 115V, single-phase; 60-cycle; manual starter with over-all protection with dust collector	X	1	X	1

II. AUXILIARY PLASTICS EQUIPMENT

	Introductory	Quantity	Advanced	Quantity
Buffer, Pedestal 2-6" x 1" muslin wheels, wide clearance design; motor 1/3HP, 1725 RPM, 115V, 60-cycle, single-phase, manual starter, overload protection	X	2	X	2
Scale, Laboratory will weigh 100 grams	X	1	X	1
Strip heater 22" length; 110V; 250W; switch and pilot light	X	1	X	1
Timer, Interval 120 minute cap. by seconds	X	1	X	1
Tester, Guided bend maximum reader; ream source 10,000; stroke 5"	X		X	1
Tester, Hardness type; M scale; ¼" ball, 10-100 kg load			X	1

II. Auxiliary Plastics Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Testing Machine, Tensile maximum rated cap. 40,000 lbs., stroke 4"			X	1
Welding Unit, Plastics	X	1	X	1

III. PLASTER CASTING EQUIPMENT

	Introductory	Quantity	Advanced	Quantity
Container, Plastic 100 lbs. cap.; metal or plastic with cover	X	1	X	1
Mixing Bowls (set) set of 3 sizes; stainless steel kitchen type	X	3	X	3
Scoop, Plaster	X	1	X	1
Screening Wheel approx. 18" diameter	X	1	X	1

IV. FINISHING EQUIPMENT

	Introductory	Quantity	Advanced	Quantity
Spray Booth, Dry 5'W x 7'H x 4' working depth; fire deflector curtain and paint arrestor filter cells	X	1	X	1
Spray Gun Outfit	X	1	X	1

V. WOODWORKING EQUIPMENT

	Introductory	Quantity	Advanced	Quantity
Dresser, Abrasive wheel	X	1	X	1
Drill, Electric, Portable (¼")	X	1	X	1
Drill, Electric, Portable (½")	X	1	X	1
Grinder, Edge tool (bench) 1" x 7" motor, including a fine grit and one coarse wheel; motor ½HP, 60-cycle, 110V with overload protection	X	1	X	1

V. Woodworking Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Jointer (6") motor ½HP, 60-cycle, 3-phase, 208 or 220V with magnetic switch and overload protection	X	1	X	1
Lathe, Spinning (12") variable speed drive; 650-3450 RPM; motor 1HP, magnetic starter; 208 or 220V; 3-phase	X	1	X	1
Lathe Wood turning 12" swing; motor ¾HP, 60-cycle; 208 or 220V; 3-phase; switch and overload protection; including cup center, spur center, 3 face plates, 1-6" tool rest, 1-12" tool rest, 1 tool support base, 1 knock-out bar	X	1	X	1
Press, Drill (15") 15" cap.; variable speed; number 2 Morse taper in spindle; floor model; ½" key chuck; tilting standard table; with ½HP, 220V, 3-phase motor, and magnetic switch and starter	X	1	X	1
Router, Portable, Electrical ½ or 7/8HP	X	1	X	1
Sander, Belt, Portable, Electrical 3" x 24" or 4" x 24"; 115V AC motor	X	1	X	1
Sander, Spindle 19" oscillating abrasive sleeves; on floor stand; motor ½HP, 3-phase, 60-cycle; 208 or 220V, with magnetic switch and starter	X	1	X	1
Saw, Band, Wood-cutting 15" floor model; motor ½HP, 60-cycle; 208 or 220V, 3-phase; with magnetic switch and starter	X	1	X	1

V. Woodworking Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Saw, Circular, Power 10" floor model; motor ½HP, 60-cycle; 208 or 220V; 3-phase, with magnetic switch and starter or 12" floor model	X	1	X	1
Saw, Jig (scroll) 2", metal stand; motor 1/3HP; 115V	X	1	X	1
Saw, Sabre (bayonet) portable; heavy duty; 115V, 60-cycle AC	X	1	X	1

VI. METAL WORKING EQUIPMENT

Bender, Universal on stand; cap. radius 6"-12"; ½" round mild steel; including accessories for variety of common bends, flats, rounds, tubing	X	1	X	1
Brake, Box and pan 24"; cap. 16 ga., 3" deep; 0-135	X	1	X	1
Flask, Foundry (small) 10" x 12"; cap. 3" deep, diagonal 3" deep			X	1
Forming Roll, Slip 30"; cap. mild steel; 22 ga.	X	1	X	1
Furnace, Crucible maximum cap. number 16 crucible			X	1
Grinder, Belt 1½"W belt; 1HP, 208 or 220V; 3-phase; magnetic switch guards	X	1	X	1
Lathe, Metalworking (10") minimum distance between centers 24" cabinet models; underneath drive; quick change gear box; 54 thread and spindle changes L.H. or R.H. from 4 to 224; speeds from 50 to 1500 RPM; motor ¾HP; 208 or 220V; 3-phase; drum switch and			X	1

VI. Metalworking Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
magnetic starter. Equipped with drive plate, spindle adapter, centers for head-stock and tailstock, tool post, ring and rocker, thread chasing dial and tool post wrench, 3-jawed chuck, 4-jawed chuck				
Pantograph, Metalworking 2 or 3 dimensional; enlargement up to 1:16; 208 or 220V, single-phase; appropriate cutters			X	1
Saw, Hack, Power minimum cap. 6" x 6"; swivel, (adv.) vise; automatic stop; pressure feed control; automatic lift on reverse stroke; built-in collant tank and pump; motor ½HP; 208 or 220V; 3-phase; magnetic push button starter; minimum cap. 5" x 5"; swivel vise; automatic stop; automatic lift on reverse stroke; motor 1/3HP; 208 or 220V; 3-phase; magnetic push button starter			X	1
Shear, Squaring foot maximum cap. mild steel; 16 ga.; minimum cutting length 36"; anti-pinch and toe guard	X	1	X	1
Shearing and Forming Machine, Universal cap. 5/32" mild steel; throat 42" deep; motor 1HP, 208 or 220V, 3-phase, with magnetic switch and starter			X	1
Testing Machine, Universal maximum rated cap. 40,000, 5" ram travel			X	1
Welder, Arc (AC/DC)			X	1
Welder, Spot	X	1	X	1
Welding Outfit, Oxyacetylene			X	1

VII. Hand Tools	Introductory	Quantity	Advanced	Quantity
VII. HAND TOOLS				
Awl, Brad	X	2	X	2
Bit, Auger (set) size 4-16, single thread screw	X	1	X	1
Brace, Ratchet 10"; box ratchet	X	1	X	1
Caliper, Inside (6") solid nut	X	1	X	1
Caliper, Outside (6") solid nut	X	1	X	1
Chisel, Butt (set) 3" blade; plastic handles; sizes ¼", ½", ¾", 1", 1¼", 1½"	X	2	X	2
Chisel, Carving (set) set of 6; approx. 6"L	X	2	X	2
Chisel, Cold (set) cutting edges of ¼", 3/8", ½", ¾"	X	2	X	2
Chisel, Socket firmer (set) set of 6; sizes ¼", 3/8", ½", 5/8", ¾", 1"	X	1	X	1
Chisel, Wood turning (set) 14"L	X	1	X	1
Circle Cutter heavy duty; ½" round shank; cap. 1"-8" diameter; 6 extra tools	X	1	X	1
Clamp, Bar (36")	X	8	X	8
Clamp, Bar (48")	X	4	X	4
Clamp, "C" (6")	X	12	X	12
Clamp, "C" (8")	X	6	X	6
Clamp, Spring (no. 3) heavy gauge steel; opening 3"	X	12	X	12
Countersink , Bit (for brace) (set) size 5/8" and 3/4"	X	1	X	1

VII. Hand Tools (cont.)	Introductory	Quantity	Advanced	Quantity
Divider, Spring (6")	X	1	X	1
Drill, Hand (¼")	X	1	X	1
Drill, Hand (3/8")	X	1	X	1
Drill Stand, Fractional for twist drills; from 1/16"-1/2" by 64ths	X	1	X	1
Drill, Twist (number set) high speed steel; straight shank; nos. 1-60	X	1	X	1
Drill, Twist (fractional set) straight shank; high speed steel; 1/16" to 1/2" by 64ths	X	1	X	1
Extractor, Screw (set)	X	1	X	1
Files (assorted sizes, shapes and cuts, with handles, as specified)				

Length	Name or Shape	Cut	Introductory	Quantity	Advanced	Quantity
10"	Mill	Second-Cut	X	6	X	6
10"	Mill	Bastard	X	6	X	6
10"	Half-round	Second-Cut	X	6	X	6
10"	Half-round	Bastard	X	6	X	6
8"	Round	Second-Cut	X	6	X	6
8"	Round	Bastard	X	6	X	6
6"	Warding		X	6	X	6
10"	Cabinet Rasp	Second-Cut	X	3	X	3

VII. Hand Tools (cont.)	Introductory	Quantity	Advanced	Quantity
File Card and Brush 9½"L, brush 1½" x 5"	X	6	X	6
File, Needle (set) set of 12; 5½"L; assorted shapes	X	1	X	1
Gauge, Auger bit for gauging hole depth	X	1	X	1
Gauge, Marking	X	1	X	1
Gauge, Wire and sheet metal (American) sizes 0-36	X	1	X	1
Gauge, Wire and sheet metal (U.S.S.) sizes 0-36	X	1	X	1

VII. Hand Tools (cont.)	Introductory	Quantity	Advanced	Quantity
Goggles (spectacles), Clear observation	X	20	X	20
Graduate Cylinder (100cc)	X	2	X	2
Graduate Cylinder (500cc)	X	2	X	2
Hammer, Ball peen (12 oz.)	X	1	X	1
Hammer, Soft face	X	2	X	2
Hammer, Claw (16 oz.)	X	2	X	2
Helmet, Welding (arc) (hand type)			X	2
Helmet, Welding (head type)			X	1
Mallet, Rawhide (10 oz.)	X	2	X	2
Micrometer, Outside (1") graduated in .001"	X	1	X	1
Micrometer, Outside (2") graduated in .001"	X	1	X	1
Nail Set (1/16" tip)	X	6	X	6
Oiler, Bench 1/3 or 1/2 pts. size; 5" straight spout	X	6	X	6
Oilstone, Combination, India coarse and fine grits; 8" x 1" x 2"	X	2	X	2
Oilstone, Combination, Silicon carbide coarse and fine grits; 8" x 1" x 2"	X	2	X	2
Pipet Control, Microsyringe			X	1
Plane, Jack 14"L; cutter 2"W	X	2	X	2
Pliers, Combination (6")	X	1	X	1
Pliers, Combination (8")	X	1	X	1
Pliers, Diagonal cutting (6")	X	1	X	1
Pliers, End cutting (6")	X	1	X	1
Pliers, Straight nose (8")	X	1	X	1
Pliers, Tongue (10")	X	1	X	1

VII. Hand Tools (cont.)	Introductory	Quantity	Advanced	Quantity
Pliers, Vise-grip wrench (7")	X	1	X	1
Punch, Center (set) set of 5; 1/16"-1/4"; with tapered point	X	3	X	3
Punch, Hand (set) set of 7 punches and dies; 3/32"-9/32"; metal box	X	1	X	1
Punch, Pin (set) 4"L; diameter 1/16"-1/2" by 32nds	X	1	X	1
Rule, Steel (12")	X	6	X	6
Rule, Steel (24")	X	6	X	6
Sanding Drums (set)	X	1	X	1
Saw, Back (12")	X	2	X	2
Saw, Coping (6½")	X	2	X	2
Saw, Hack (hand) adjustable to receive 9"-12" blades	X	2	X	2
Saw, Hand, Crosscut 22"; 10 point	X	2	X	2
Scissors (8")	X	1	X	1
Scraper, Cabinet malleable iron with 2¾" blade	X	2	X	2
Scraper, Hand approx. 3" x 5" steel blade	X	6	X	6
Screwdriver, Standard bit (round blade) (set) set of 5; blade widths 3/16", ¼", 5/16", 3/8", ½"	X	6	X	6
Shield, Face	X	6	X	6
Snips, Tinner's, Straight (number 8)	X	2	X	2
Square, Combination (12")	X	6	X	6
Square, Combination set (with protractor and center head) (12")	X	1	X	1

VII. Hand Tools (cont.)	Introductory	Quantity	Advanced	Quantity
Square, Steel framing 12" x 24"	X	2	X	2
Tap and Die, NC (U.S. standard) (set) size: ¼-20, 5/16-18, 3/8-16, 7/16-14, ½-13	X	1	X	1
Tap and Die, NF (S.A.E.) (set) size: ¼-28, 5/16-24, 3/8-24, 7/16-20, ½-20	X	1	X	1
T Bevel, Sliding (6")	X	1	X	1
V Block and Clamps (set)	X	1	X	1
Wrench, Adjustable end (6")	X	1	X	1
Wrench, Adjustable end (8")	X	1	X	1
Wrench, Adjustable end (10")	X	1	X	1
Wrench, Adjustable end (12")	X	1	X	1
Wrench, Allen key (hex) (set) set of 11, nos.½-12	X	1	X	1
Wrench, Combination box and open (set) 3/8"-1"	X	1	X	1
Wrench, Socket (3/8" drive) (set) size 3/8"-3/4" by 16ths	X	1	X	1

VIII. GENERAL FURNISHINGS

VIII. GENERAL FURNISHINGS	Introductory	Quantity	Advanced	Quantity
Bench, Arc welding 2 stations with fireproof curtains			X	1
Bench, Gas welding 2 station style; fire brick top			X	1
Bench, Machine hard maple top; approx. 2¼" x 40" x 96"; height 32"	X	2	X	2
Bench, Metalworking (4 place) top 2½" x 24" x 4' long; laminated maple; legs heavy gauge steel	X	2	X	2

VIII. General Furnishings (cont.)	Introductory	Quantity	Advanced	Quantity
Bench, Molding steel construction, approx. 30" x 32"H	X	1	X	1
Bench, Plaster stainless steel top, approx. 26" x 96"	X	1	X	1
Bench, Woodworking (4 place) 2¼" x 54" x 64"; laminated maple top; 2 wood or metal base units; 36"W x 21"D x 3"H; equipped with 4 vises	X	4	X	6
Bookcase approx. 60"H x 10"-12"D x 72"L, 3 adjustable shelves, wood or metal	X	1	X	1
Broom, Push 18" in length	X	3	X	3
Brush, Bench	X	12	X	12
Cabinet, Filing 4 drawer, 52"H x 15"W x 28½"D	X	1	X	1
Cabinet, Finishing supply approx. 36" x 12" x 84" with combination box and shelves, doors with locks	X	2	X	2
Cabinet, Parts storage metal, 100 drawers	X	1	X	1
Cabinet, Sheet plastics storage metal, 12 bins	X	1	X	1
Cabinet, Tool storage approx. size 62"W x 22"D x 84"H	X	1	X	1

VIII. General Furnishings (cont.)	Introductory	Quantity	Advanced	Quantity
Can, Oily waste	X	2	X	2
Can, Safety (1 qt.)	X	6	X	6
Can, Safety (1 gal.)	X	6	X	6
Chair, Teacher's welded steel construction, swivel, with casters	X	1	X	1
Desk, Teacher's approx. 42" x 30" x 29"H welded steel construction	X	1	X	1
Fire Blanket	X	1	X	1
Fire Extinguisher	X	3	X	3
First Aid Kit	X	1	X	1
Microscope			X	1
Pan, dust (12" steel)	X	1	X	1
Pencil Sharpener, Standard	X	1	X	1
Projector, Filmstrip (35mm) and slide (2" x 2")	X	1	X	1
Projector, Motion picture, Sound	X	1	X	1
Projector, Overhead	X	1	X	1
Rack, Lumber	X	1	X	1
Rack, Metal storage	X	1	X	1
Screen, Projection 60" x 60"	X	1	X	1
Table, Overhead projector portable, 26"H	X	1	X	1
Truck, Welding cylinder				

LEVELS II, III, IV
METALS

I. Fabricating Machines and Accessories	Introductory	Quantity	Advanced	Quantity
I. FABRICATING MACHINES AND ACCESSORIES				
Bar Folder (30")	X	1	X	1
Arbor, Milling machine 1", "B" bearing			X	2
Bender, Universal on stand, cap. radius 6"-12", ½" round, mild steel, including accessories	X	1	X	1
Boring Bar (set) set of 3, 3/8", 1/2", 1/4", dia. bars			X	2
Brake, Box and pan 24", cap. 16 ga. depth of box 3"	X	1	X	1
Buffer, Long arm pedestal, 33" between wheels, 5/8" arbor, motor ¾HP, 3450 RPM, 208V or 220V, 3-phase, 60-cycle			X	1
Buffer, Pedestal 2-6" x 1" muslin wheels, clearance design, motor 1/3HP, 1725 RPM, 115V, single-phase, 60-cycle	X	1		
Chuck, Magnetic permanent ceramic			X	1
Cutter, Milling machine, End (set) high speed steel, actual type and size to be specified according to need and machine size			X	1
Cutter, Milling machine, Gear tooth, Involute (set) high speed, diameteral pitch and number forms to be specified according to need			X	1

I. Fabricating Machines and Accessories (cont.)	Introductory	Quantity	Advanced	Quantity
Cutter, Milling machine, Helical, Plain high speed steel, diameter, width of face and arbor hole to be specified according to need			X	1
Cutter, Milling machine, Shell and arbor high speed steel, actual size and type to be specified according to need and machine size			X	1
Cutter, Milling machine, Slitting high speed steel; diameter; thickness, arbor hole and number of teeth to be specified accord. to need			X	1
Cutting-Off Tool, Lathe	X	6	X	6
Drill, Elec., Portable (¼")	X	1	X	1
Drill, Elec., Portable (3/8")			X	1
Drill, Elec., Portable (½")			X	1
Electroplating Unit 50 amps.; 0-9V	X	1	X	1
Forge, Gas			X	1
Forming, Roll, Slip 30"; cap. mild steel; 22 ga.	X	1	X	1
Furnace, Crucible maximum cap., no. 16 crucible	X	1	X	1
Furnace, Heat treating beginning: fire box; 5"H x 7½"W x 13½"L; advanced: fire box; 7"H x 13"W x 16½"L	X	1	X	1
Grinder, Heavy duty pedestal 12" with self-contained dust collector, motor 2HP; 220V or 208V; 3-phase, 60-cycle, magnetic starter			X	1

I. Fabricating Machines and Accessories (cont.)	Introductory	Quantity	Advanced	Quantity
Grinder Pedestal 1" x 7" model, included one fine grit and one coarse wheel, motor ½HP; 220 or 208V, 3-phase, 60-cycle	X	1	X	1
Grinder, Surface minimum table working surface 13½" x 6", minimim longitudinal feed 14"; minimum cross feed 7"; working height 0-11½"; 7" wheel; spindle motor 1HP, 3,450 RPM; diamond dresser			X	1
Indicator, Dial test Range .030"			X	2
Jolt Squeezer, Foundry size 17" x 20" x 10"D, cap. 6,000 lbs.			X	1
Knurling Tool, Lathe (coarse) to fit tool post of lathe ordered			X	6
Knurling Tool, Lathe (fine) to fit tool post of lathe ordered			X	6
Knurling Tool, Lathe (medium) to fit tool post of lathe ordered			X	6
Lathe, Metalworking (10") minimum distance between centers 24" cabinet models; underneath drive; quick change gear box; 54 thread and spindle changes L.H. or R.H. from 4 to 224; speeds from 50 to 1500 RPM; motor ¾HP, 208V or 220V, 3-phase, drum switch and magnetic starter. Equipped with drive plate, spindle adapter, centers for head-stock and tailstock, tool post, ring and rocker, thread chasing dial and tool post wrench, 3-jawed chuck, 4-jawed chuck	X	3	X	6

I. Fabricating Machines and Accessories (cont.)	Introductory	Quantity	Advanced	Quantity
Lathe, Metalworking (14") minimum distance between centers 36"; capacity through spindle 1-1/16"; cam lock spindle nose; center Morse Taper no. 3; spindle speeds; direct drive 215 to 875 RPM, backgeared 30 to 130 RPM; quick change gear box 4 to 224 threads per inch; tailstock spindle no. 3 Morse taper; thread indicator dial; with 3-jawed and 4-jawed chuck; taper attachment, face plate; tool post assembly; centers and spindle sleeve; motor; 2HP, 208V or 220V, 3-phase, pushbutton line starter control-forward, reverse, stop and magnetic reversing linestarter			X	2
Lathe, Spinning (12") variable speed drive; speeds 650 to 3450 RPM; 1HP motor; 208V or 220V; 3-phase; magnetic starter; metal spinning face plate; spinning tool rest with fulcrum pins; spinning center; spur center and cut center; set of metal spinning tools; set of wood turning chisels			X	1
Mandrel, Expansion (set) set; range 3/8" to 2½"			X	2
Mandrel, Set sizes: ¼", 5/16", 3/8", 7/16", ½", 5/8", ¾", 7/8", 1"			X	1
Milling Machine, Horizontal no. 3 Knee and Column, plain style, specifications may vary according to need—these features, however, should be considered: fast, easy feed selection, directional feed controls, power rapid traverse, built-in backlash eliminator, spindle speeds selections, convenient electrical controls, ruggedness of construction, trip dogs and positive safety stops, easy chip removal and sump cleaning, anti-friction bearings, positive lubrication, safety features and simplicity			X	1

I. Fabricating Machines and Accessories (cont.)	Introductory	Quantity	Advanced	Quantity
of maintenance; includes Morse Taper adaptor				
Milling Machine, Universal spindle C/L to table top with cutterhead horizontal 0 to 23", spindle nose to table top with cutterhead, vertical 0-17" with adjustable cutterhead that can be positioned through a full 90°for vertical, angular, or horizontal milling. Other features to be considered: gib design, spindle drive motor, feed motor, coolant system, table working surface, saddle, ram, overarm, feed ranges, spindle speeds, controls, and lubrication			X	1
Milling Machine, Vertical approx. range, 9" x 40" table working surface, longitudinal table travel 26". cross travel 10". vertical travel of knee 18" vertical travel of spindle 5", turret to rotate 360 degrees on column, head to rotate 360 degrees on ram. Other features to be considered: gibs, accuracy and movement of all bearing surfaces, spindle bearings, spindle tapers, spindle speeds, 4-way head, balanced pulleys, power feed table, motors and electrical controls			X	1
Oven, Core lab type; 0-550 degrees, inside dimensions approx. 12"W x 10"H x 10"D, automatic thermal control			X	1
Press Arbor 3 ton cap.; gear driven			X	1
Press, Drill (15") 15" cap.; variable speed; no. 2 Morse taper in spindle; floor model; ½" key chuck; tilting standard table; with ½HP, 208V or 220V, 3-phase motor, and magnetic switch and starter	X	2	X	1
Press, Drill (17") floor model; variable speed 300 to 3100 RPM; production table with raising and lowering mechanism; no. 3 Morse taper spindle; key chuck, ½" capacity; belt and pulleys completely guarded; ¾HP motor (minimum); 208V or 220V; 3-phase; push button magnetic control and starter			X	1
Rotary Machine, Combination			X	1
Sand Blaster			X	1
Sand Muller booth; sand blast gun and hose; cap. approx. 25 lbs. of dry material			X	1
Saw, Band (power), Metal cutting, 18" cap., speeds 50-2000 FPM, attached blade welding device, 208V or 220V, 3-phase, with magnetic switch and starter.			X	1
Saw, Hack (power) minimum cap. 6" x 6"; swivel, (adv.) vise; automatic stop; pressure feed control; automatic lift on reverse stroke, built-in collant tank and pump; motor ½HP; 208 or 220V; 3-phase; magnetic push button starter; minimum cap. 5" x 5" swivel vise; automatic stop; automatic lift on reverse stroke; motor 1/3HP; 208 or 220V; 3-phase; magnetic push button starter	X	1	X	1
Setting Down Machine			X	1
Shaper, Metal 12"-15" stroke; specifications to be included according to need: cutting speeds, table travel—horizontal and vertical, tool head, drive unit, lubricating system, drive unit including motor and switches, cross feed—power and hand, vise, and shaper tools			X	1
Shear, ring and circle cap. 20 ga.; mild steel			X	1
Shear, Squaring, foot cap. 16 ga.; mild steel	X	1	X	1

I. Fabricating Machines and Accessories (cont.)	Introductory	Quantity	Advanced	Quantity
Spray Gun Outfit general shop	X	1	X	1
Tension Tester, Core			X	1
Tester, Hardness bench, Rockwell system, regular hardness test, 10 to 150 kg. and superficial tests 3-45 kg.			X	1
Tool Holder, Lathe (left hand) to fit tool post of lathe ordered	X	6	X	6
Tool Holder, Lathe (right hand) to fit tool post of lathe ordered	X	6	X	6
Tool Holder, Lathe (straight) to fit tool post of lathe ordered	X	6	X	6
Torch, Gas	X	2	X	2
Welder, Arc (AC/DC)	X	1	X	1
Welder, MIG			X	1
Welder, Spot	X	1	X	1
Welder, TIG			X	1
Welding Outfit, Oxyacetylene include a regulator, touch, set of tips, cutting attachments and set of tips, twin hose	X	1	X	1

II. HAND TOOLS AND EQUIPMENT

Anvil (100 lb.)	X	1	X	1
Apron, Foundry leather, approx. 44"L	X	2	X	2
Apron, Rubber	X	1	X	2
Apron, Welding leather, approx. 44"L	X	2	X	2
Awl, Scratch (6")	X	4	X	4
Bellows, Molder's (8")	X	1	X	1

II. Hand Tools and Equipment	Introductory	Quantity	Advanced	Quantity
Broom, Push (10")	X	3	X	3
Brush, Bench	X	12	X	12
Brush, Wire overall length 10"	X	6	X	6
Bulb, Sponge 8 oz., rubber bulb	X	1	X	1
Caliper, Hermaphrodite (6") lock joint			X	2
Caliper, Inside (6") solid nut, bolt spring	X	6	X	6
Caliper, Outside (6") solid nut, bolt spring	X	6	X	6
Caliper, Outside (8") solid nut, bolt spring			X	2
Caliper, Vernier 5" cap.			X	1
Can, Oily waste 10 gal. cap.	X	1	X	1
Can, Safety (1 qt.)	X	2	X	2
Can, Safety (1 gal.)	X	2	X	2
Chisel, Cape ½" stock, ¼" cutting edge	X	2	X	2
Chisel, Cold (set) cutting edge of ¼", 3/8", ½", ¾"	X	1	X	2
Chisel, Diamond point (set) ¼", 3/8", ½" bits	X	1	X	2
Chisel, Round nose (set) ¼", 3/8" bits	X	1	X	2
Clamp, "C" (4")	X	4	X	4
Clamp, "C" (6")	X	4	X	4
Clamp, "C" (8")	X	4	X	4
Clamp, "C" (10")	X	4	X	4
Countersink, Bit (for brace) (set) sizes: 5/8" and 3/4"	X	1		

II. Hand Tools and Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Countersink, High speed steel ¼" shank, ½" size	X	1		
Crucible (no. 4)	X	2	X	2
Crucible (no. 10)	X	2	X	3
Crucible Hand Shank (no. 4)	X	1	X	1
Crucible Lifter (2-man)	X	1	X	1
Crucible Ring Shank 2-man, for nos. 8, 10, 12 crucible	X	1	X	1
Cutter, Bolt (minimum 14")	X	1	X	1
Cutter, Pipe cap. 1/8"-1" diameter			X	1
Cutter, Sprue ¾" x 10"	X	1	X	1
Die, Dapping 2½ cube, 21 sphere, 3/16" to 2 3/16"	X	1	X	1
Die, Letter (set) 3/16" character height	X	1	X	1
Die, Number (set) 3/16" character height	X	1	X	1
Divider, Spring (4") solid nut			X	2
Divider, Spring (6") solid nut	X	6	X	6
Divider, Spring (8") solid nut			X	2
Dresser, Abrasive wheel	X	1	X	1
Drill, Hand (¼")	X	1	X	1
Drill, Hand (3/8")	X	1	X	1
Drill Stand, Fractional 1 twist drill from 1/16" to ½" by 64ths	X	1	X	1
Drill, Twist (letter set) high speed steel; straight shank	X	1	X	1

II. Hand Tools and Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Drill, Twist (number set) high speed steel; straight shank	X	1	X	1
Drill, Twist (fractional set) high speed steel; straight shank	X	1	X	1
Drill, Twist (fractional set) Taper set high speed steel, no. 2 Morse Taper, 5/8"-1" by 8ths	X	1	X	1
Extractor, Screw (set) set of 6, no. 1 - no. 6	X	1	X	1
Files (assorted sizes, shapes, and cuts, with handles, as specified)				

Length	Name or Shape	Cut	Introductory	Quantity	Advanced	Quantity
8"	Flat Double-Cut	Bastard	X	4	X	4
10"	Flat Double-Cut	Bastard	X	4	X	4
4"	Mill	Smooth	X	6	X	6
6"	Mill	Smooth	X	6	X	6
8"	Mill		X	6	X	6
6"	Round	Second-Cut	X	2	X	2
8"	Round	Bastard	X	6	X	6
8"	Three-Square (Triangular)	Second-Cut	X	4	X	4

II. Hand Tools and Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
File Card and Brush 9½"L, brush 1½" x 5"	X	6	X	6
Flask, Foundry (large) 12" x 18"; cap. 4" deep, drag 4" deep	X	4	X	4
Flask, Foundry (small)	X	4	X	4
Gauge, Center spring tempered	X	3	X	6
Gauge, Drill point			X	1
Gauge, Micrometer, Depth calibrated thousandths; 0-3"			X	1
Gauge, Radius and fillet with radii from 1/32" to 17/32" by 64ths			X	1

II. Hand Tools and Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Gauge, Screw pitch with 22 pitches, 9-40	X	1	X	1
Gauge, Small hole set of 4; from 1/8" to 1/2"			X	1
Gauge, Surface base 3 1/8" x 2½"			X	1
Gauge, Telescopic set; ½" to 6"			X	1
Gauge, Thickness ("feeler") minimum 6" leaf, ½" x 2½" x .0015 to .015	X	1	X	1
Gauge, Vernier height minimum 0-12"			X	1
Gauge, Wire and sheet metal (American) sizes 0-36	X	1	X	1
Gauge, Wire and sheet metal (U.S.S.) sizes 0-36	X	1	X	1
Gloves, Asbestos (pair) unlined, 14"L, medium size	X	2	X	2
Gloves, Leather (pair) cowhide	X	4	X	6
Gloves, Thick rubber (pair) thin latex	X	2	X	2
Goggles (spectacles), Clear observation	X	24	X	24
Goggles, Gas welding	X	3	X	3
Groover, Hand (set) set of 3; sizes 0, 2, 4	X	2	X	2
Hammer, Ball peen (8 oz.)	X	2	X	2
Hammer, Ball peen (12 oz.)	X	4	X	4
Hammer, Ball peen (16 oz.)	X	2	X	2
Hammer, Ball peen (30 oz.)			X	2
Hammer, Ball peen (32 oz.)			X	2
Hammer, Chipping			X	2
Hammer, Engineer's (40 oz.)	X	2	X	2

II. Hand Tools and Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Hammer, Engineer's (48 oz.)	X	1	X	1
Hammer, Riveting, Machinist's (9 oz.)	X	2	X	2
Hammer, Soft face (4 oz.) with replaceable plastic faces	X	2	X	2
Hammer, Soft face (8 oz.) with replaceable plastic faces	X	2	X	2
Helmet, Welding (arc) (head type) no. 10 lens and cover	X	2	X	2
Leggings, Molder's (pair)	X	2	X	2
Mallet, Hardwood	X	4	X	4
Mallet, Rawhide (10 oz.)	X	4	X	2
Mallet, Rubber approx. 2"	X	2	X	2
Micrometer, Inside (set) range 2" to 12"	X	1	X	1
Micrometer, Outside (1") graduated in .001", with spindle lock and ratchet adjustment	X	4	X	6
Micrometer, Outside (2") graduated in .001", with spindle lock and ratchet adjustment	X	2	X	2
Micrometer, Outside (3") graduated in .001", with spindle lock and ratchet adjustment	X	1	X	1
Micrometer, Outside (screw thread) pitch diameter 0-1", graduated in .001", 14" to 30" threads per inch			X	1
Micrometer, Outside (screw thread)			X	1
Mold, Ingot	X	1	X	1
Nipper, End cutting (6")	X	1	X	1
Oiler, Bench 1/3 or 1/2 pt. size, 5" straight spout	X	12	X	12

II. Hand Tools and Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Oilstone, Combination, India coarse and fine grit, 8" x 1" x 2"	X	2	X	2
Pan, Dust (12" steel)	X	1	X	1
Parallels, Adjustable (set) set of 6 with cap., range 3/8" to 2¼"			X	1
Pencil Sharpener, Standard	X	1	X	1
Plate, Angle 4" x 5" x 6"			X	2
Plate, Surface 10" x 15"			X	1
Pliers, Combination (6")	X	6	X	6
Pliers, Combination (8")	X	4	X	4
Pliers, Diagonal cutting (6")	X	2	X	2
Pliers, Needle nose (6")	X	2	X	2
Pliers, Straight nose (8")	X	2	X	2
Pliers, Vise-grip wrench (7")	X	2	X	2
Punch, Center (set) set of 5; 1/16" to 1/4"	X	4	X	6
Punch, Drive (set) set of 5; punch dia. 1/8"-3/8"; 8"L	X	1	X	1
Punch, Hollow (set) 3/8", 1/2", 5/8", 3/4", 1", 1½", 2"	X	1	X	1
Rammer, Hardwood	X	2	X	2
Reamer, Center (set) 60 degrees included angle; high speed; sizes 1/4", 3/8", 1/2", 5/8", 3/4"	X	1	X	1
Reamer, Expansion (set) set of 8; A-H			X	1
Reamer, Pipe 1/8"-1"; round shank	X	1	X	1
Riddle, Foundry wire screen, no. 8 mesh	X	2	X	2

II. Hand Tools and Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Rivet Set (set) set of 5; sizes nos. 3-7	X	4	X	4
Rule, Circumference (36") tinners; standard measurements to 8ths	X	2	X	2
Rule, Flexible, Steel tape (12')	X	2	X	2
Rule, Hook (12"L)			X	4
Rule, Short (set) short set of 5; with holder; ¼" to 1"			X	1
Rule, Steel (6") 10th, 100ths, 32nds, 64ths	X	6	X	8
Rule, Steel (12") graduated to 1/16"	X	12	X	12
Rule, Steel (24") graduated to 1/16"	X	2	X	2
Saw, Hack (hand) adjustable to receive 9"-12" blade	X	6	X	6
Saw, Jeweler's (4")	X	2	X	2
Saw, Jeweler's (6")	X	4	X	4
Scissors (8")	X	1	X	1
Screwdriver, Offset, Phillips (set) set of tips 3/16", 9/32", and 11/32"			X	1
Screwdriver, Offset, Straight slot (set)	X	1	X	1
Screwdriver, Phillips (set) set with points nos. 1, 2, 3	X	1	X	1
Screwdriver, Standard bit (round blade) (set) set of 5; blade widths 3/16", 1/4", 5/16", 3/8", 1/2"	X	2	X	2
Scriber complete with 3 points: 1 straight, 1 short bent, 1 long bent	X	6	X	6
Seamer, Handy	X	2	X	2

II. Hand Tools and Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Shield, Face	X	12	X	12
Shovel, Square point	X	1	X	1
Sleeves, Molder's (18"L)	X	1	X	1
Slick and Oval (1")	X	1	X	1
Slick and Oval (1¼")	X	1	X	1
Snip, Aviation (left) 10"L	X	2	X	2
Snip, Aviation (right) 10"R	X	2	X	2
Snip, Aviation (combination and straight) (10"L)	X	2	X	2
Snips, Hawkbill (3" cut)	X	1	X	1
Snips, Tinner's, Straight (no. 8)	X	4	X	4
Snips, Tinner's, Straight (no. 10)	X	2	X	2
Soldering Copper, Electric (60W)	X	1	X	1
Soldering Copper, Electric (200W)	X	1	X	1
Soldering Copper, Electric (300W)			X	1
Soldering Copper (pair) ½ lb.	X	4	X	2
Soldering Copper (pair) 1 lb.	X	2	X	2
Soldering Copper (pair) 1½ lb.	X	1	X	1
Sparklighters	X	6	X	6
Square, Combination (12")	X	6	X	6
Square, Combination set (with protractor and center head) (12")	X	1	X	1
Stake, Beakhorn	X	1	X	1
Stake, Blowhorn	X	1	X	1
Stake, Bottom			X	1

II. Hand Tools and Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Stake, Candle mold	X	1	X	1
Stake, Conductor			X	1
Stake, Double seaming set with 4 edges			X	1
Stake, Grooving			X	1
Stake, Hatchet	X	1	X	1
Stake, Hollow mandrel	X	1	X	1
Stake, Needle case			X	1
Stake, Round head			X	1
Tap and Die, Machine screw (set) including the following sizes: 4-36, 6-32, 8-32, 10-24, 10-32, 12-24, ¼-20	X	1	X	1
Tap and Die, NC (U.S. standard) (set) Taper, plug and bottoming tap plus one die in following sizes: ¼-20, 5/16-18, 3/8-16, 7/16-14, 1/2-13 complete with die stock and tap wrench	X	1	X	1
Tap and Die, NF (S.A.E.) (set) Taper, plug and bottoming tap plus one die in following sizes: ¼-28, 5/16-24, 3/8-24, 7/16-20, ½-20 complete with die stock and tap wrench	X	1	X	1
Tap and Die, Pipe (set) tap die and reamer for following sizes: 1/8", ½", ¾", 1"	X	1	X	1
Tongs, Blacksmith, Curved lip 20"L	X	2	X	2
Tongs, Pick up (flat lips) 24"	X	2	X	2
Trammel Points	X	1	X	1
Trowel, Foundry			X	1

II. Hand Tools and Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Truck, Welding cylinder size appropriate to the gas bottle size	X	1	X	1
V Block and Clamps (set)	X	1	X	2
Vise, Angle, Drill cap. of opening 2¼" (beginning); cap. of opening 3" (advanced)	X	1	X	2
Vise, Bench, Drill cap. for opening 3"	X	2	X	2
Vise, Machinist's bench swivel base, 3 jaw, 4¾" opening	X	12	X	12
Vise, Pin (set) range 0-.125" minimum	X	1	X	1
Vise, Pipe	X	1	X	1
Wrench, Adjustable end (6")	X	2	X	2
Wrench, Adjustable end (8")	X	2	X	2
Wrench, Adjustable end (10")			X	2
Wrench, Adjustable end (12")			X	2
Wrench, Allen Key (hex) (set)	X	1	X	1
Wrench, Box (set) range of opening ¼"-1"	X	1	X	1
Wrench, Open end (set) ¼"-1"	X	1	X	1
Wrench, Pipe (10")	X	1	X	1
Wrench, Pipe (14")			X	1
Wrench, Pipe (18")			X	1
Wrench, Socket (3/8" drive) (set) 10 piece set; 7 standard sockets; sizes 3/8"-3/4" by 16ths	X	1	X	1
Wrench, Socket (½" drive) (set) 9 piece set; 7 standard sockets; sizes 3/8"-3/4" by 16ths	X	1	X	1

III. General Furnishings	Introductory	Quantity	Advanced	Quantity
III. GENERAL FURNISHINGS				
Bench, Arc welding with fire proof curtains; 2 station	X	1	X	2
Bench, Gas welding with fire brick top; 2 station	X	1	X	2
Bench, Machine laminated maple top, approx. size 96" x 40" x 2¼"; height 32", angle iron edges, one stake plate	X	1	X	1
Bench, Metalworking (2 place) laminated maple top, approx. size 60" x 40" x 2¼", height 32", angle iron edges	X	2	X	2
Bench, Metalworking (4 place) laminated maple top, approx. size 4' x 24" x 2¼", angle iron edges, heavy gauge steel legs, height 30"	X	4	X	4
Bench, Molding steel construction, approx. size 60" x 30" x 32"H	X	1	X	1
Bench, Sheet metal (with stake plates) laminated maple top, approx. size 60" x 40" x 2½", height 32", angle iron edge	X	1	X	1
Bench, Soldering steel, transite cover top, 6' x 30" x 32"H	X	2	X	1
Bench, Spot welding all steel construction; 5' x 24" top	X	1	X	1
Bench, TIG welding fire brick top			X	1
Bookcase approx. 60"H x 10-12"D x 72"L, 3 adjustable shelves, wood or metal	X	1	X	1
Cabinet, Filing 4 drawers, 52"H x 15"W x 28½"D	X	1	X	1

III. General Furnishings (cont.)	Introductory	Quantity	Advanced	Quantity
Cabinet, Finishing (storage) steel construction, adjustable shelves, 2 doors with locks	X	1	X	1
Cabinet, Small parts steel, 36" x 12" x 73"H, double doors with lock	X	1	X	1
Cabinet, Storage steel, 36" x 18" x 78"H, double door with lock	X	4	X	6
Cabinet, Tool storage approx. 62" x 22" x 83"H with doors and lock	X	1	X	1
Chair, Teacher's welded steel construction, swivel, with casters	X	1	X	1
Compressor, Air 120 p.s.i., 60 gal. tank, 1½HP motor, 208V or 220V	X	1	X	1
Desk Teacher's approx. 72" x 30" x 29", welded steel construction	X	1	X	1
Fire Blanket	X	1	X	1
Fire Extinguisher	X	3	X	3
First Aid Kit	X	1	X	1

III. General Furnishings (cont.)	Introductory	Quantity	Advanced	Quantity
Furnace, Bench gas, 2 burner	X	2	X	2
Projector, Filmstrip (35mm) and slide (2" x 2")	X	1	X	1
Projector, Motion picture, Sound	X	1	X	1
Projector, Overhead	X	1	X	1
Rack, Metal storage vertical, approx. 4'W x 9'H, or for horizontal storage, 2 racks 84"H x 21" sq. at the bottom	X	1	X	1
Screen, Projection 60" x 60"	X	1	X	1
Spray Booth, Dry 3'6"W x 6'1"H, working depth 1'1"; ½HP fan motor			X	1
Stool, Student's adjustable 14" seat, height without adjustment 26"	X	24	X	24
Table, Drafting overall size approx. 38" x 28" x 39"H, wood or metal	X	1	X	1
Table, Overhead projector	X	1	X	1

LEVELS II, III, IV
POWER

I. Hand Tools	Introductory	Quantity	Advanced	Quantity
I. HAND TOOLS				
Battery, Storage (6V)	X	1	X	1
Battery, Storage (12V)	X	1	X	1
Brush, Wire overall length 10-14"; width 1"	X	8	X	2
Caliper, Hermaphrodite (6")			X	1
Caliper, Inside (8")	X	1	X	1
Caliper, Outside (6")			X	1
Caliper, Vernier 5" capacity			X	1
Chisel, Cold (set) cutting edges of ¼", 3/8", ½", ¾"	X	4	X	4
Clamp, "C" (4")	X	2	X	2
Clamp, "C" (6")	X	2	X	2
Clamp, "C" (8")	X	2	X	2
Clamp, "C" (10")	X	2	X	2
Cleaner, Ring Groove	X	1	X	1
Compressor, Piston ring (set) capacity 1 3/8"-7"	X	1	X	2
Compressor, Valve spring	X	2	X	2
Cutter, Bolt minimum 14"; 3/8" soft capacity	X	1	X	1
Cutter, Bushing			X	1
Cutter, Muffler adjustable 1½"-2½"			X	1
Cutter, Pipe cap. 1/8"-1" diameter			X	1
Cutter, Tubing 1/8"-1" cap.	X	1	X	1

I. Hand Tools (cont.)	Introductory	Quantity	Advanced	Quantity
Die, Letter (set) 3/16" character height	X	1	X	1
Die, Number (set) 3/16" character height	X	1	X	1
Divider, Spring (6")	X	1	X	1
Dresser, Abrasive wheel	X	1	X	1
Drill, Hand (¼")	X	1	X	1
Drill, Hand (3/8")	X	1	X	1
Drill Stand, Fractional	X	1	X	1
Drill, Twist (number set) high speed steel; straight shank	X	1	X	1
Drill, Twist (fractional set) high speed steel; straight shank	X	2	X	2
Extension Cord heavy duty; grounded, 25'	X	6	X	6
Extractor, Screw (set) set of 6; nos. 1-6	X	1	X	1
Files (assorted sizes, shapes, and cuts, with handles, as specified)				

Length	Name or Shape	Cut	Introductory	Quantity	Advanced	Quantity
10"	Half-round	Smooth	X	2	X	2
10"	Half-round	Bastard	X	6	X	6
10"	Lathe (Long Angle, Safe Edge)		X	3	X	3
10"	Brass (Flat)		X	3	X	3
10" x 3/8"	Round	Bastard	X	2	X	2
8" x ¼"	Round	Bastard	X	2	X	2
10" x 3/8"	Square	Bastard	X	2	X	2
6"	Slim Taper (triangular)		X	3	X	3

(con't.)

I. Hand Tools (cont.)	Introductory	Quantity	Advanced	Quantity
8” Warding	X	2	X	2
10” Flat Second-Cut Bastard	X	3	X	3
10” Half-round Bastard	X	6	X	6
10” Round Bastard	X	6	X	6
10” Aluminum (Flat)	X	3	X	3
File Card and Brush 9½”L	X	6	X	6
File, Contact point (ignition) 2½” blade	X	1	X	1
Flaring Tool (set) range 3/16”-5/8”			X	1
Flywheel holder for small gas engine	X	1	X	1
Gauge, Center	X	1	X	1
Gauge, Cylinder pressure gauge range 0-300 p.s.i.	X	1	X	1
Gauge, Drill, Fractions	X	1	X	1
Gauge, Drill, Number	X	1	X	1
Gauge, Ignition (set)	X	2	X	2
Gauge, Screw pitch from 9-40			X	2
Gauge, Spark plug	X	3	X	3
Gauge, Spring tension	X	1	X	1
Gauge, Surface base 3 1/8” x 2½”; 2 spindle; 9” x 12”; with scriber			X	1
Gauge, Thickness (“feeler”) minimum 6 leaf, ½” x 2½”; .0015-.015	X	8	X	8
Gauge, Vacuum and low pressure	X	1	X	1
Gauge, Wire and sheet metal (American) sizes 0-36	X	1	X	1
Gauge, Wire and sheet metal (U.S.S.) sizes 0-36	X	1	X	1

I. Hand Tools (cont.)	Introductory	Quantity	Advanced	Quantity
Gloves, Leather (pair)	X	2	X	2
Goggles (spectacles), Clear observation	X	6	X	6
Goggles, Gas welding	X	4	X	4
Grease Gun, Suction, General Purpose	X	1	X	1
Hammer, Ball peen (4 oz.)	X	4	X	4
Hammer, Ball peen (8 oz.)	X	4	X	4
Hammer, Ball peen (16 oz.)	X	4	X	4
Hammer, Brass head 1 lb.; 3”L; 1¼” diameter	X	2	X	2
Hammer, Chasing 1”; with handle attachment			X	1
Hammer, Chipping			X	2
Hammer, Claw (16 oz.)	X	1	X	1
Hammer, Engineer’s (40 oz.)	X	2	X	2
Hammer, Lead (3 lb.)	X	2	X	2
Hammer, Sledge (5 lb.) medium length handle			X	1
Hammer, Soft face (8 oz.)	X	2	X	2
Helmet, Welding (hand type)	X	3	X	3
Helmet, Welding (arc) (head type)	X	2	X	2
Hydrometer	X	1	X	1
Indicator, Dial test range 2½”-6”; in graduation of .001”			X	1
Mallet, Rawhide (10 oz.)	X	2	X	2
Mallet, Rubber length of head 3½”; rubber face approx. 2”	X	2	X	2
Micrometer, Inside with range of 2”-12”	X	1	X	1
Micrometer, Outside (1”)	X	1	X	1
Micrometer, Outside (2”)	X	1	X	1

I. Hand Tools (cont.)	Introductory	Quantity	Advanced	Quantity
Micrometer, Outside (3")	X	1	X	1
Micrometer, Outside (4")			X	1
Micrometer, Outside (5")			X	1
Nipper, End cutting 6"; compound action	X	1	X	1
Nozzle, Blow gun (air line)	X	1	X	1
Oiler, Bench 1/3-1/2 pint size	X	6	X	6
Oiler, Pump (5 oz.)	X	6	X	6
Oiler, Straight (½ pint)	X	6	X	6
Oilstone, Combination, India coarse and fine grits; 8" x 1" x 2"	X	2	X	2
Oilstone, Combination, Silicon carbide coarse and fine grits; 8" x 1" x 2"	X	2	X	2
Pliers, Battery heavy duty; 6 7/16"L	X	2	X	2
Pliers, Chain	X	1	X	1
Pliers, Combination (6")	X	8	X	8
Pliers, Combination (8")	X	6	X	6
Pliers, Diagonal cutting (6")	X	2	X	2
Pliers, Hose clamp, Radiator and gas line (8")			X	1
Pliers, Ignition	X	2	X	2
Pliers, Needle nose (6")	X	4	X	4
Pliers, Retaining ring (5" or 8")	X	2	X	2
Pliers, Side-cutting (6")	X	8	X	8
Pliers, Vise-grip wrench (7")	X	2	X	2
Pliers, Waterpump	X	2	X	2
Press, Arbor hydraulic; 25 ton capacity	X	1	X	1

I. Hand Tools (cont.)	Introductory	Quantity	Advanced	Quantity
Puller Assembly 3 hole application; center screw	X	1	X	1
Puller Assembly (large) 2-way puller set			X	1
Puller, Axle			X	1
Puller, Freeze plug			X	1
Puller, Gear (set) 3-jaw reversed gear puller			X	1
Puller, Seal (set) with adaptor range from 1 3/8"-2 7/16"			X	1
Puller, Steering wheel			X	1
Puller, Valve guide and valve			X	1
Saw, Hack (hand) adjustable to receive 9"-12" blade	X	4	X	4
Scissors (8")	X	2	X	2
Scraper, Carbon	X	8	X	8
Screwdriver, Clutchhead (set)	X	1	X	1
Screwdriver, Phillips (set)	X	2	X	2
Screwdriver, Spiral ratchet			X	1
Screwdriver, Standard bit (square blade) (4")	X	2	X	2
Screwdriver, Standard bit (square blade) (6")	X	2	X	2
Screwdriver, Standard bit (square blade) (8")	X	2	X	2
Screwdriver, Standard bit (square blade) (10")	X	2	X	2
Screwdriver, Standard bit (square blade) (12")	X	2	X	2
Screwdriver, Standard bit ("stubby")	X	4	X	4
Puller, Wheel (set)			X	1

I. Hand Tools (cont.)	Introductory	Quantity	Advanced	Quantity
Pump, Oil drum for 55 gallon drums	X	2	X	2
Punch, Center (set) set of 5; 1/16"-1/4" diameter	X	4	X	4
Punch, Drift (set) 3/32"-1/2" by 32nds	X	4	X	4
Punch, Pin (set) 4"L; 1/16"-1/2" diameter by 32nds	X	1	X	1
Reamer, Cylinder ridge range 2 11/16"-5 5/16" with tungsten carbide cutter			X	1
Reels, Drop cord 3 wire; 50'; heavy duty	X	4	X	4
Remover, Stud (set) wedged type action; ½" square drive			X	1
Rethreader, Axle sizes 5/8"-18, 3/4"-16, 7/8"-14, 1"-14, 1 1/8"-12, 1¼"-12			X	1
Rethreader, Spark plug hole			X	1
Rule, Flexible steel tape (10')	X	1	X	1
Rule, Steel (12")	X	4	X	4
Scriber complete with 3 points: 1 straight, 1 short, and 1 bent	X	2	X	2
Shield, Face	X	4	X	4
Snips, Tinner's Straight (number 8)	X	1	X	1
Soldering Gun, Electric	X	1	X	1
Spout, Pouring, Oil can	X	1	X	1
Strap, Battery	X	2	X	2
Tap and Die, NC (U.S.S.) (set) Taper plug and bottoming tap plus one die in following sizes: ¼-20, 5/16-18, 3/8-16, 7/16-14, ½-13; complete with die stock and tap wrench	X	1	X	1
Tap and Die, NF (S.A.E.) (set) Taper plug and bottoming tap plus one die in following sizes: ¼-28, 5/16-24, 3/8-24, 7/16-20, ½-20; complete with die stock and tap wrench	X	1	X	1
Tap and Die, Pipe (set) tap, die and reamer for pipe sizes: 1/8", 1/2", 3/4", 1"	X	1	X	1
Tester, Battery cell	X	1	X	1
Tester, Radiator pressure	X	1	X	1
Tool Holder, Lathe (left hand) to fit tool post of lathe ordered			X	1
Tool Holder, Lathe (right hand) to fit tool post of lathe ordered			X	1
Tool Holder, Lathe (straight) to fit tool post of lathe ordered			X	1
Torch, Propane (kit)			X	1
Wrench, Adjustable end (6")	X	2	X	2
Wrench, Adjustable end (8")	X	2	X	2
Wrench, Adjustable end (10")	X	2	X	2
Wrench, Adjustable end (12")	X	2	X	2
Wrench, Adjustable end (monkey)	X	2	X	2
Wrench, Allen key (hex) (set) set inclues 11 standard sizes: nos. ½-12	X	2	X	2
Wrench, Combination box and open end (set)	X	4	X	4

I. Hand Tools (cont.)	Introductory	Quantity	Advanced	Quantity
range of openings 3/8"-1"				
Wrench, Combination box and open end (metric) (set) set of 10 sizes: 6, 8, 9, 10, 12, 13, 14, 15, 17, 19 mm	X	1	X	1
Wrench, Socket, Flex handle (3/8" drive)			X	2
Wrench, Socket, Flex handle (½" drive)			X	2
Wrench, Socket, Handle extension (3/8" drive) (4")	X	2	X	2
Wrench, Socket, Handle extension (3/8" drive) (3")	X	2	X	2
Wrench, Socket, Handle extension (3/8" drive) (set)	X	2	X	2
Wrench, Socket, Handle extension (½" drive) (3")	X	2	X	2
Wrench, Socket, Handle extension (½" drive) (8")	X	2	X	2
Wrench, Socket, Handle extension (½" drive) (set)	X	2	X	2
Wrench, Socket, Reversible ratchet handle (¼" drive)	X	2	X	2
Wrench, Socket, Reversible ratchet handle (3/8" drive)	X	4	X	4
Wrench, Socket, Reversible ratchet handle (½" drive)	X	6	X	6
Wrench, Socket, Speed handle (¼" drive)	X	2	X	2
Wrench, Socket, Speed handle (3/8" drive)	X	4	X	4
Wrench, Socket, Speed handle (½" drive)	X	6	X	6
Wrench, Socket, Universal joint attachment (¼" drive)			X	2
Wrench, Socket, Universal joint attachment (3/8" drive) (set)	X	2	X	2
Wrench, Socket, Universal joint attachment (½" drive) (set)	X	4	X	4

I. Hand Tools (cont.)	Introductory	Quantity	Advanced	Quantity
Wrench, Tappet (set)	X	1	X	1
Wrench, Torque (3/8" drive)	X	1	X	1
Wrench, Torque (½" drive)	X	1	X	1
Wrench, Deep Socket (3/8" drive) (set) 3/8"-9/16", 5/8"-13/16", 5/8"-3/16" by 16ths	X	1	X	1
Wrench, Deep socket (½" drive) (set) ½"-15/16" by 16ths	X	1	X	1
Wrench, Drain plug	X	2	X	2
Wrench, Lug	X	2	X	2
Wrench, Flare nut (set) size 3/8", 7/16", ½", 9/16", 5/8"			X	1
Wrench, Ignition (set)	X	1	X	1
Wrench, Pipe (10")	X	2	X	2
Wrench, Pipe (18")			X	1
Wrench, Socket (¼" drive) (set) 3/16"-½" by 32nds	X	2	X	2
Wrench, Socket (3/8" drive) (set) 10 piece, 4 sockets, sizes 3/8"-3/4" by 16ths	X	4	X	4
Wrench, Socket (½" drive) (set) 9 piece set, 7 sockets, sizes 3/8"-3/4" by 16ths	X	6	X	6
Wrench, Socket (metric) (set) ½" drive; size 9mm-22mm			X	2

II. MACHINES AND GENERAL EQUIPMENT

Alternator-Generator-Regulator Test Stand alternator test equipment, set			X	1
Analyzer, Capacitor			X	1
Analyzer, Engine			X	1
Anvil (100 lb.)	X	1	X	1

II. Machines and General Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Battery Eliminator and Charger	X	1	X	1
Boring Bar (cylinder set)			X	1
Can, Oil filler and measure (1 qt.)	X	2	X	2
Can, Oil filler and measure (2 qt.)	X	1	X	1
Can, Oil filler and measure (5 qt.)	X	1	X	1
Can, Oily waste	X	3	X	3
Can, Radiator (2 gal.)			X	1
Can, Safety (1 qt.)	X	3	X	3
Can, Safety (1 gal.)	X	2	X	2
Carburetor Repair set			X	1
Cleaner, Spark plug	X	1	X	1
Cleaner, Valve guide wire brush, twist wire shank; 5/16", 11/32", 3/8", 7/16" diameter			X	1
Clutch Aligner (set)			X	1
Crane, Portable (2 ton cap.)			X	1
Drill, Electric, Portable (¼")	X	2	X	2
Drill, Electric, Portable (3/8")	X	1	X	1
Drill, Electric, Portable (½")			X	1
Engine, Automobile with transmission and clutch in running condition	X	1	X	1
Engine, Diesel small 100HP or less	X	1	X	1
Engine, Outboard motor	X	1	X	1
Engine, Rocket (small or model)			X	1
Engine, Small (2-cycle)	X	1	X	1

II. Machines and General Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Engine, Small (4-cycle)	X	1	X	1
Engine, Steam (model)			X	1
Engine, Turbine (small)	X	1	X	1
Fluidic Training Center			X	1
Grease Gun	X	1	X	1
Galvanometer			X	1
Grease Gun, Chassis			X	1
Grease Gun, Extended interval			X	1
Grease Gun, Gear lube			X	1
Grinder, Edge tool (bench) 1" x 7" model; 1 fine grit and 1 coarse wheel; motor ½HP; 60-cycle; 110V with overload protection	X	1	X	1
Grinder, Flexible shaft			X	1
Grinder, Pedestal 1" x 7" model; 1 fine grit and 1 coarse wheel; motor ½HP; 60-cycle; 110V with overload protection			X	1
Grinder, Valve (set) motor 1/3HP; 115V; 60-cycle			X	1
Growler, Armature testing 120V; 60-cycle; 2 scale meter; 2 ranges (0-5 amps., 0-25 amps.)	X	1	X	1
Gun, Engine cleaning	X	1	X	1
Hydraulic Instruction Unit			X	1
Jack, Auto, Hydraulic (Standard Type) (2 ton)			X	1
Lathe, Armature			X	1
Lathe, Metalworking (10") minimum distance between centers 24" cabinet models; underneath drive; quick change gear box; 54 thread and spindle changes L.H. or R.H. from			X	1

II. Machines and General Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
4 to 224; speeds from 50 to 1500 RPM; motor ¾HP, 208V or 220V, 3-phase drum switch and magnetic starter. Equipped with drive plate, spindle adapter, centers for headstock and tailstock, tool post, ring and rocker, thread chasing dial and tool post wrench, 3-jawed chuck, 4-jawed chuck				
Lift, Engine safety 30"L; included hook and adaptor; 2 ton capacity			X	1
Milliammeter, Volt-ohm			X	2
Motor Stand, Universal			X	1
Multiscope			X	1
Pneumatic Instruction Center (pneumatic power unit)			X	1
Press, Drill (15") 15" cap.; variable speed; number 2 Morse taper in spindle; floor model; ½" key chuck; tilting standard table; with ½HP, 220V, 3-phase motor, and magnetic switch and starter			X	1
Press, Drill (17") floor model; variable speed; 300-3100 RPM; production table with raising and lowering mechanism; number 3 Morse taper spindle; key chuck, ½" capacity; belt and pulleys completely guarded; ¾HP motor (minimum); 220V; 3-phase; push button magnetic control and starter			X	1
Radiator, Test Plug (set)			X	1
Reamer, Expansion (set) set of 8; A-H			X	1
Reamer, Valve seat (set)			X	1
Refacer, Valve (set)			X	1
Rheostat, 10 ohm			X	1
Sander, Finishing, Portable, Air			X	1

II. Machines and General Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Spray Gun Outfit			X	1
Tachometer			X	1
Tank, Hot boiling			X	1

III. GENERAL FURNISHINGS

	Introductory	Quantity	Advanced	Quantity
Bench, Metalworking (4 place) top 2¼"T x 24"W x 7'L; laminated maple; angle iron edges; heavy gauge steel legs	X	2	X	2
Bookcase approx. 60"H x 10-12"D x 72"L; wood or steel	X	1	X	1
Broom, Push 18" in length; 3" trim; handle	X	3	X	3
Brush, Bench 8" brush, 3" overall	X	12	X	12
Cabinet, Filing 4 drawer; size 52"H x 15"W x 28½"D	X	1	X	1
Chair, Teacher's welded steel construction, swivel base, with casters	X	1	X	1
Compressor, Air 120 p.s.i.; 60 gal. tank; motor 1½HP; 3-phase; 208V or 220V; automatic pressure control	X	1	X	1
Desk, Teacher's approx. 42" x 30" x 29"H; welded steel construction	X	1	X	1
Fire Blanket	X	1	X	1
Fire Extinguisher	X	3	X	3
First Aid Kit	X	1	X	1
Hose, Air 25' x 14"; heavy duty; flexible	X	1	X	1
Hose, Exhaust, Garage	X	1	X	1
Hose, Water 50'; garden type	X	1	X	1

II. Machines and General Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Pan, Dust (12" steel)	X	1	X	1
Pencil Sharpener, Standard	X	1	X	1
Projector, Filmstrip (35mm) and slide (2" x 2")	X	1	X	1
Projector, Motion picture, Sound	X	1	X	1
Projector, Overhead	X	1	X	1
Screen, Projection 60" x 60"	X	1	X	1
Stand, Auto safety (2 ton)	X	20	X	20
Stand, Auto safety (7 ton)	X	6	X	6
Table, Overhead projector	X	1	X	1
Welding Screen, Portable back 6' x 6'; wings 3'; double frame construction; replaceable fireproof curtains			X	1

II. Machines and General Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Tank, Parts cleaning, Solvent 40 gallon capacity	X	1	X	1
Tester, Coil and condensor 6-12-24V, portable			X	1
Tester, Distributor			X	1
Transformer, Step-down			X	1
Transformer, Step-up			X	1
Truck, Welding cylinder size appropriate to gas bottle size			X	1
Vise, Machinist's bench swivel base; 3" jaw; 4¾" opening	X	1	X	1
Welder, Arc (AC/DC)			X	1
Welding outfit, Oxyacetylene			X	1

LEVELS II, III, IV
WOODS

I. Fabricating Machines	Introductory	Quantity	Advanced	Quantity
I. FABRICATING MACHINES				
Drill, Electric, Portable (¼")	X	1	X	1
Drill, Electric, Portable (3/8")			X	1
Grinder, Edge tool (bench) 1" x 7" model including one fine grit and one coarse grit wheel; motor ½HP; 60-cycle; 110V with overload protection	X	1	X	1
Grinder, Oil Tool floor model 2-1½" x 6" oilstone; wheel, one coarse and one fine grit; ½" x 8" emery wheel; ¼HP; 110V; 60-cycle	X	1	X	1
Jointer (6") floor model; motor ½HP; 60-cycle; 3-phase; 208V or 220V; with magnetic switch and overload protection	X	1	X	1
Jointer (8") long bed; floor model; motor ½HP; 60-cycle; 3-phase; 208V or 220V; with magnetic switch and overload protection			X	1
Lathe, Wood turning 12" swing, minimum 38" between center; motor ¾HP; 60-cycle; 208V or 220V; 3-phase; with mounted switch and overload protection; to include cup center, spur center, 3 face plates, one 6" tool rest, 1 tool support base, 1 knock-out base	X	3	X	3
Mortiser, Hollow chisel floor model with ½" mortise capacity and to handle stock up to 20"L. Complete with compound table and lateral adjustments, hold down attachment and foot lever control. Machine to include one each of the following drills and hollow chisel bits: ¼", 5/16", 3/8", 7/16", and ½" and ¼" and 5/16" bit bushings. Motor: 1HP, 60-cycle, 208 or 220V; 3-phase; with mounted switch and overload protection			X	1
Plane, Portable, Electric (16")			X	1
Press, Drill (15") 15" capacity; variable speed; number 2 Morse taper in spindle; floor model; ½" key chuck; tilting standard table; with ½HP, 3-phase motor, and magnetic switch and starter	X	1	X	1
Router, Portable, Electric ½ or 7/8HP motor	X	1	X	1
Sander, Belt, Portable, Electric 3" x 24" or 4" x 24"; 115V AC	X	1	X	1
Sander, Combination belt and disc 6" belt; 12" disc, floor model; motor 1HP, 50-cycle, 208V or 220V; 3-phase; magnetic switch and starter	X	1	X	1
Sander, Finishing, Porable, Electric (heavy duty)	X	1	X	1
Sander, Handblock stroke 6" belt with sock cap. 4" thick, 60"L; motor 1HP; 3-phase; 60-cycle; 208 or 220V with magnetic switch and starter			X	1
Sander, Spindle 19" oscellating abrasive sleeves; floor stand; motor ½HP, 3-phase, 208 or 220V with magnetic switch and starter	X	1	X	1
Saw, Band, Woodcutting	X	1	X	1

I. Fabricating Machines (cont.)	Introductory	Quantity	Advanced	Quantity
14" floor model; motor ½HP, 60-cycle, 208V or 220V, 3-phase with magnetic switch and starter or 20" model, motor 1½HP				
Saw, Circular, Power 10" floor model with motor 1½HP, 60-cycle, 208V or 220V, 3-phase with magnetic switch and starter or 12" model, motor 5HP	X	1	X	1
Saw, Jig (scroll) 24"; metal stand; motor 1/3HP, 60-cycle AC, 115V with magnetic switch and starter	X	1	X	1
Saw, Radial-arm, Power 10" saw complete with stand, table extensions; motor totally enclosed and fan cooled; motor 2HP, 60-cycle, 208V or 220V, 3-phase; with magnetic switch and starter			X	1
Saw, Sabre (bayonet) portable; heavy duty			X	1
Shaper, Spindle (floor model) complete with interchangeable spindles 5/16", 1/2", 3/4", and 1" adjustable fence, hold down guides and fence guard assembly; motor 1HP, 50-cycle, 208V or 220V, 3-phase, including reversible switch and overload protection			X	1
Surfacer (single surface planer) 12" x 5" cap; floor model; motor 3HP, 50-cycle, 208V or 220V, 3-phase with magnetic switch and starter and overload protection; or 18" or 20" cap; floor model; motor 5HP, 60-cycle, 208V or 220V with switch and overload protection			X	1
II. HAND TOOLS AND EQUIPMENT				
Awl, Brad	X	2	X	2

II. Hand Tools and Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Awl, Scratch (6")	X	4	X	4
Bar, Wrecking forged steel, hex stock; ¾" x 24"L	X	1	X	1
Bellows, Molder's (8")	X	4	X	4
Bit, Auger (set) sizes 4-16	X	2	X	2
Bit, Combination drill and countersink (set) numbers 1-5	X	1	X	1
Bit, Combination drill and counterbore (set)	X	1	X	1
Bit, Electrician's 18"L x 5/16"D			X	1
Bit, Expansive boring size from 7/8" to 3"	X	1	X	1
Bit, Extension (18")	X	1	X	1
Bit, Forstner (brace set) sizes 6, 8, 10, 12, 14, 16 by 16ths of an inch	X	1	X	1
Bit, Forstner (machine set) ½" shank; sizes 6, 8, 10, 12, 14, 16 in 16ths of an inch	X	1	X	1
Bit, Multi-spur (set) set of 11; sizes ½"-1" by 16ths; plus 1 1/8" and 1¼"	X	1	X	1
Bit, Plug cutter (set) set of 5; sizes 3/8", ½", 5/8", ¾", 1"	X	1	X	1
Bit, Twist, Electrician's 3/8" x 18" with square tang	X	1	X	1
Block, Sanding rubber, to use 2¾" x 9" paper	X	24	X	24
Brace, Ratchet (10")	X	5	X	5
Bracket, Saw horse (pair) steel; 12" x 4" lumber	X	2	X	2

II. Hand Tools and Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Broom Push 18" in length	X	6	X	6
Brush, Bench	X	24	X	24
Burnisher round tempered steel; 4½" blade	X	1	X	1
Can, Oily waste 10 gallon capacity	X	1	X	1
Can, Safety (1 qt.)	X	4	X	4
Can, Safety (1 gal.)	X	3	X	3
Chisel, Butt (set) 3" blade; sizes ¼", ½", ¾", 1" 1½"	X	12	X	12
Chisel, Carving (set) set of 6 chisels and gauges; approx. 6" long	X	4	X	4
Chisel, Gouge, Inside (set) sizes ¼", 3/8", ½", ¾", 1"	X	3	X	3
Chisel, Gouge, Outside (set) set of 5; sizes ¼", 3/8", ½", ¾", 1"	X	3	X	3
Chisel, Socket firmer (set) set of 6; sizes ¼", 3/8", ½", 5/8", ¾", 1"	X	4	X	4
Chisel, Wood turning (set) overall length at least 17"	X	3	X	3
Circle Cutter cap. 1" to 8" diameter	X	1	X	1
Clamp, Bar (36")	X	6	X	6
Clamp, Bar (48")	X	6	X	6
Clamp, "C" (3")	X	4	X	4
Clamp, "C" (4")	X	4	X	4
Clamp, "C" (6")	X	4	X	4
Clamp, "C" (8")	X	4	X	4
Clamp, Corner 3" capacity	X	4	X	4

II. Hand Tools and Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Clamp, Fixture (set) for use with ¾" pipe	X	6	X	6
Clamp, Handscrew (no. 3/0)	X	6	X	6
Clamp, Handscrew (no. 0)	X	6	X	6
Clamp, Handscrew (no. 1)	X	12	X	12
Clamp, Handscrew (no. 2)	X	12	X	12
Clamp, Handscrew (no. 3)	X	6	X	6
Clamp, Mitre frame	X	1	X	1
Compass, Pencil	X	3	X	3
Countersink Bit (for brace) (set) size 5/8" and 3/4"	X	2	X	2
Countersink, High Speed ¼" shank, ½" size	X	2	X	2
Cutter, Glass	X	1	X	1
Die, Letter (set) 3/16" character height	X	1	X	1
Die, Number (set) 3/16" character height	X	1	X	1
Divider, Wing (6" steel)	X	2	X	2
Dowel Centers (pairs) (set) ¼", 5/16", 3/8", ½"	X	1	X	1
Dresser, Abrasive wheel	X	1	X	1
Drill, Hand (¼")	X	2	X	4
Drill, Hand (3/8")	X	1	X	1
Drill Stand (fractional) for twist drills from 1/16" to 1/2" by 64ths	X	1	X	1
Drill, Twist, Straight shank (fractional set) high speed, number 2 Morse Taper Shank; 5/8"-1" by 8ths	X	1	X	1
Files (assorted sizes, shapes, and cuts, with handles, as specified)				

Length	II. Hand Tools and Equipment (cont.) Name or Shape	Introductory	Quantity	Advanced	Quantity
7"	Slim, Taper (Triangular) Single	X	3	X	3
10"	Half-round Rasp	X	6	X	6
10"	Round Rasp	X	6	X	6
10"	Cabinet Double-Cut (Half-round)	X	12	X	12
	File, Auger bit (7")	X	3	X	3
	File Card and Brush 9½"L, brush 1½" x 5"	X	6	X	6
	Funnel	X	2	X	2
	Gauge, Auger bit gauging hole depth	X	1	X	1
	Gauge, Drill, Fractions	X	1	X	1
	Gauge, Marking	X	6	X	6
	Gauge, Marking (double bar)	X	2	X	2
	Gauge, Screw pitch with 22 pitches from 9 to 40	X	1	X	1
	Gauge, Wire and sheet metal (American) sizes 0-36	X	1	X	1
	Gauge, Wire and sheet metal (U.S.S.) sizes 0-36	X	1	X	1
	Gloves, Leather (pair)	X	4	X	4
	Goggles, Clear observation	X	24	X	24
	Grease Gun	X	1	X	1
	Hammer, Claw (7 oz.)	X	3	X	3
	Hammer, Claw (13 oz.)	X	6	X	6
	Hammer, Claw (16 oz.)	X	6	X	6
	Hammer, Magnetic standard upholstered	X	2	X	2

II. Hand Tools and Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Hose, Air 25' x 14"; heavy duty	X	1	X	1
Jig, Dowelling with guides 3/16", 1/4", 5/16", 3/8", 7/16", 1/2"	X	2	X	2
Knife, Putty approx. 1"W; flexible tool steel blade	X	3	X	3
Knife, Sloyd blade approx. 2 5/8"L	X	6	X	6
Level (24" long)	X	1	X	1
Mallet, Hardwood	X	4	X	4
Mallet, Rawhide (10 oz.)	X	4	X	4
Miter Box 26" x 4" back saw; 8¼" right angle cap.	X	1	X	1
Nail Set (1/16" tip)	X	4	X	4
Nail Set (3/32" tip)	X	4	X	4
Nipper, End cutting (6")	X	1	X	1
Nozzle, Blow gun (air line)	X	1	X	1
Oiler, Bench 1/3 or 1/2 pt. size, 5" straight spout	X	6	X	6
Oiler, Pump 5 oz. capacity	X	1	X	1
Oilstone, Carving tool slips (set)	X	1	X	1
Oilstone, Combination, India coarse and fine grit; 8" x 1" x 2"	X	1	X	1
Oilstone, Gouge slip	X	1	X	1
Pan, Dust (12" steel)	X	1	X	1
Plane, Block 1 5/8" cutter	X	3	X	3

II. Hand Tools and Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Plane Iron, Double	X	24	X	24
Plane, Jack (14"L)	X	18	X	18
Plane, Jointer (22"L)	X	2	X	2
Plane, Rabbet 4"L; 1" cutter	X	4	X	4
Plane, Router with 3 cutters (¼", ½" and V)	X	4	X	4
Plane, Smoothing length: 9", blade width: 1¾"	X	6	X	6
Pliers, Combination (6")	X	2	X	2
Pliers, Vise-grip wrench (7")	X	2	X	2
Protractor, Machinist's bevel 12" balde	X	2	X	2
Punch, Center (set) set of 5: 1/16"-1/4"	X	3	X	3
Rule, Flexible Steel tape (6')	X	4		
Rule, Flexible Steel tape (8')			X	4
Rule, Flexible, Steel tape (10')	X	4	X	4
Rule, Flexible, Steel tape (25')	X	1	X	1
Rule, Flexible, Steel tape (50')			X	1
Rule, Flexible, Steel tape (100')	X	1	X	1
Rule, Steel (12")	X	18	X	18
Rule, Steel (24")	X	6	X	6
Rule, Steel (36")	X	3	X	3
Sanding Drums (set)	X	1		
Saw, Back (12")	X	6	X	6

II. Hand Tools and Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Saw, Coping 6½"L, pin-end	X	12	X	12
Saw, Hack (hand) adjustable to receive 9-12" blade	X	1	X	1
Saw, Hand, Crosscut 22"-10 point	X	4	X	4
Saw, Hand, Rip 26"-5½ point, straight back	X	4	X	4
Saw, Keyhole 10" taper; round blade	X	1	X	1
Saw, Veneer			X	4
Scale, Architect's graduation 3/32", 1/8", 3/16", 1/4", 3/8", 1/2", 3/4", 1", 1½", 3", each equalling 1" - 0"	X	1	X	1
Scissors (8")	X	4	X	4
Scraper, Cabinet 2¾" blade	X	4	X	4
Scraper, Hand approx. 3" x 5" steel blade	X	6	X	6
Screwdriver, Offset ratchet	X	1	X	1
Screwdriver, Offset, Straight slot (set) set of tips of 3/16", 9/32" and 11/32"	X	2	X	2
Screwdriver, Phillips (set) set of points numbers 1, 2, 3	X	2	X	2
Screwdriver, Spiral ratchet	X	2	X	2
Screwdriver, Standard bit (round blade) (set) blades 3/16", 1/4", 5/16", 3/8", 1/2"	X	2	X	2
Shield, Face	X	12	X	12
Soldering Copper, Electric (60W) ¼" copper tip with stand	X	1	X	1

II. Hand Tools and Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Spokeshave, Convex bottom	X	4	X	4
Spokeshave, Straight	X	4	X	4
Spray Gun Outfit	X	1	X	1
Square, Combination (12")	X	2	X	2
Square, Steel framing 12" x 24"	X	6	X	6
Square, Try (6")	X	24	X	24
Square, Try (12")	X	4	X	4
T Bevel (6")	X	3	X	2
Trammel Points	X	2	X	2
Triangle, 30 degrees - 60 degrees (8")	X	1	X	1
Triangle, 45 degrees (8")	X	1	X	1
T Square minimum size 24"	X	1	X	1
Vise, Bench, Drill 3" opening	X	1	X	1
Vise, Miter	X	1	X	1
Wrench, Adjustable end (8")	X	1		
Wrench, Allen key (hex) (set) set includes sizes numbers 1½-12	X	1	X	1
Wrench, Open end (set) size ¼"-1"	X	1	X	1
Wrench, Socket (3/8" drive) (set) 10 piece set, 7 standard sockets; 3/8"-3/4" by 16ths	X	1	X	1

III. EXPERIMENTAL AND RESEARCH EQUIPMENT

	Introductory	Quantity	Advanced	Quantity
Balance, Beam			X	1
Hot Plate, Electric (100V)			X	1

III. Experimental and Research Equipment (cont.)	Introductory	Quantity	Advanced	Quantity
Jack, Auto, Hydraulic (standard type) (1½ ton)			X	3
Meter, Galvanometer 500-0-500 micro amps.			X	1
Meter, Moisture content (electric)			X	1
Meter, Volt-ohm (multi-range)			X	1
Microscope 10x Hygenian eyepiece with pointer, triple revolving nose-pieces; 3 standard objectives; 4x, 10x, 43x; plain stage with side clips; fixed in stage condensor; iris diaphragm; in base illuminator	X	1	X	1
Oven 12"W x 10"H x 10"D; 220V, 3-phase or 110V, single-phase			X	1
Press, Hydraulic, Heated platen minimum cap. 12 tons; with 12" x 12" platen			X	1
Scale, Household cap. approx. 5 lbs.			X	1
Scale, Laboratory precision accuracy; maximum 100 grams			X	1

IV. GENERAL FURNISHINGS

	Introductory	Quantity	Advanced	Quantity
Bench, Demonstration 1¾" x 28" x 60" table top	X	1	X	1
Bench, Electric demonstration 6' x 30"; 0-120V AC and DC outlets			X	1
Bench, Woodworking (2 place) 2¼" x 28½" x 64"; hard maple top; wood or metal; base units 36"W x	X	8	X	8

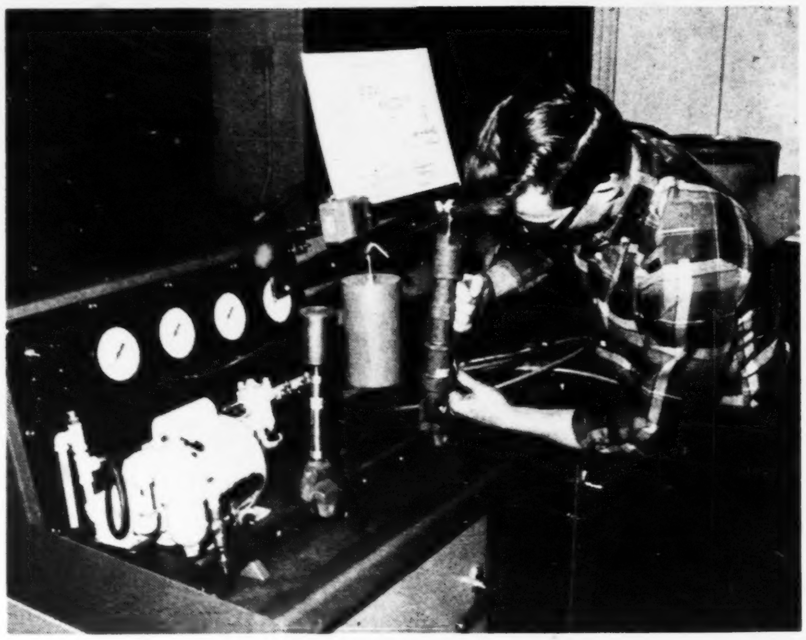
IV. General Furnishings (cont.)	Introductory	Quantity	Advanced	Quantity
21"D, overall bench height 33¼" with 2 vises				
Bench, Woodworking (4 place) 2¼" x 54" x 64"; mounted on two 36"W x 21"D x 31"H base units of wood or metal; hard maple top; with 4 vises	X	2	X	2
Bookcase approx. 60"H x 10" to 12"D x 72"L; 3 adjustable shelves, wood or metal	X	2	X	2
Cabinet, Filing 4 drawers; 52"H x 15"W x 28½"D	X	2	X	2
Cabinet, Finishing (storage) steel construction, adjustable shelves, 2 doors with locks	X	1	X	1
Cabinet, Machine accessory 36"W x 21"D x 31"H, wood or metal; 2¼" x 22" x 54", maple top	X	1	X	1
Cabinet, Nail and screw storage 22½"H x 48"; see-through plastic drawers	X	1	X	1
Cabinet, Storage 32"W x 22"D x 84"H; 7 shelves; wood or metal construction	X	1	X	1
Cabinet, Tool storage approx. 62" x 22"D x 84"H	X	1	X	1
Chair, Teacher's welded steel construction, swivel, with casters	X	1	X	1
Compressor, Air 120 p.s.i., 1½HP, 208V motor; 60 gallon tank	X	1	X	1
Desk, Teacher's 42" x 30" x 29"H, welded steel construction	X	1	X	1

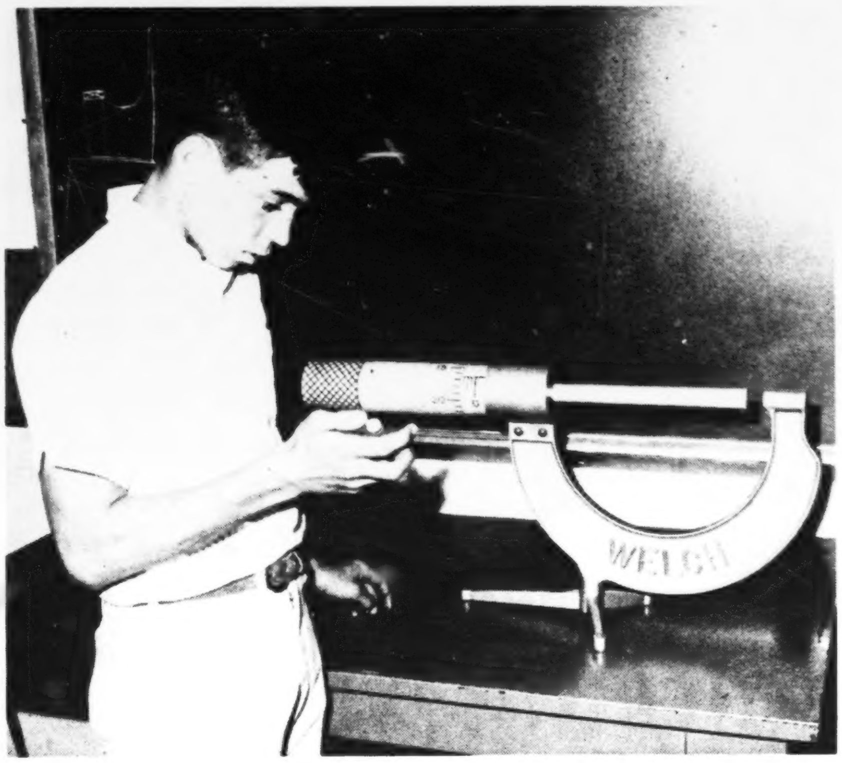
IV. General Furnishings (cont.)	Introductory	Quantity	Advanced	Quantity
Dust Collection System	X	1	X	1
Fire Blanket	X	1	X	1
Fire Extinguisher	X	3	X	3
First Aid Kit	X	1	X	1
Pencil Sharpener, Standard	X	1	X	1
Projector, Filmstrip (35mm) and slide (2" x 2")	X	1	X	1
Projector, Motion picture, Sound	X	1	X	1
Projector, Overhead	X	1	X	1
Rack, Glue Clamp 72" x 36" x 32"H	X	1	X	1
Rack, Roll, Wrapping paper (24")	X	1	X	1
Screen, Projection 60" x 60"			X	1
Spray Booth, Dry approx. size 5'W x 7'H x 4" working depth, with fire deflective curtain and paint arrestor filter cells			X	1
Table, Drafting overall size approx. 38" x 28" x 39"H, wood or metal or overall size approx. 38½" x 48" x 29"H, wood or metal	X	1	X	1
Table, Overhead projector	X	1	X	1
Table, Finishing 1¼" x 24" x 50"; ply wood top, covered with 20 ga. galvanized steel	X	1	X	1
Table, Spraying top size 50" diameter; with lazy susan; bearing attached to outside			X	1

PART V

APPENDICES

Appendix A — Design Criteria for Public School Plants
Accomodating the Physically Handicapped
Appendix B — Shop Planning Check List
Appendix C — Facility Planning Reference Chart
Appendix D — Bibliography





APPENDIX A
DESIGN CRITERIA FOR PUBLIC SCHOOL PLANTS ACCOMODATING THE PHYSICALLY DISABLED

Approximately one out of seven people in our nation has a permanent physical disability. This segment of our population represents human resources of inestimable value and is of great economic significance to the state and entire nation. [1]

The most common design and construction of building and facilities cause problems for the physically handicapped that lessen the social and economic gains now evident in the rehabilitation of these individuals. These architectural barriers make it very difficult to project the physically handicapped into normal situations of education, recreation, and employment. [2]

A recent law enacted by the 74th Missouri General Assembly, Section 8.600, RSMo 1967, relating to public buildings and facilities is as follows:

> Section 1. In all buildings and facilities for general public use and assembly which are constructed in whole or in part by the use of state funds, or the funds of any political subdivision of this state, practical design and engineering arrangements shall be made to obviate hazards to individuals with physical disabilities.
>
> Section 2. The provisions of this act shall not be applicable to any building or facility for which the contract and/or design was awarded prior to the effective date of this act.
> The effective date for this act being October 13, 1967.

The critieria presented in this publication are intended as minimum standards. They are recommended for use by architects and engineers, and others involved in planning and construction of school buildings and facilities in the state of Missouri, so that those individuals with permanent physical diabilities might pursue their interests and aspirations, develop their talents, and exercise their skills.

A. *Public Walks*

1. At least one primary walk to each building shall be not less than four feet wide and shall have a gradient no greater than five percent, unless the parallel and adjacent public thoroughfare gradient exceeds such percentage in which case the gradient to be constructed shall conform to the gradient of such parallel and adjacent public thoroughfare.

2. The primary walk shall be of a continuing common surface, not interrupted by steps or abrupt changes in level.

3. Whenever the primary walk crosses other walks, driveways, or parking lots it shall blend to a common level. This refers to a blending of walk and driveway to one surface at their juncture.

4. The primary walk or platform shall extend three feet or more beyond the swing of a door, wherever a door swings out onto a platform, ramp or walk.

5. The walk or platform area outside the primary doorway entrance shall be at the same level as the finish floor line inside the door.

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[1] **American Standards Association, Ind., American Standard Specifications for "Making Buildings and Facilities Accessible to, and Usable by, the Physical Handicapped", ASA Project A117.1 0 1951, 10 East 40th Street, New York 16, N.Y., P. 3 (Foreword)**

[2] ***Ibid*, P. 3 (Foreword)**

B. *Parking Lots*

1. A paved or hard surfaced parking area of sufficient size that is accessible and approximate to the facility shall be provided and identified for use by individuals with physical disabilities.

2. At least one walk or ramp both to and from one parking area to a given building or facility, if provided, shall be in conformity with provisions for walks or ramps as given in sections A-2 and 3 and C-1 through 7.

3. Care shall be exercised in planning a parking area for use by individuals with physical disabilities so that they are not compelled to wheel or walk behind parked cars.

C. *Ramps with Gradients and Handrails*

1. Where ramps with gradients are needed, the slope shall not exceed one foot rise in twelve feet or 8.33 percent rise.

2. Ramps shall have a surface that is nonslip.

3. Ramps shall have closed handrails on at least one side and preferably two sides, that are thirty-two inches in height, measured from the surface of the ramp, and extending at least one foot beyond the top and bottom of the ramp.

4. All outside ramps shall be at least four feet in width, and all inside building ramps shall be either corridor width or a minimum of five feet in width.

5. Ramps shall have a level platform at the top which is at least five feet by five feet. This platform shall extend at least one foot beyond each side of the doorway.

6. Ramps shall have at least six feet of straight clearance at the bottom.

7. Ramps should have level platforms at thirty foot intervals for purposes of rest and safety and shall have level platforms wherever they turn. One continuous ramp up to forty feet in length is permissible where a change in level is three feet four inches or less.

D. *Entrances*

1. At least one primary entrance to every school building or facility shall be usable by individuals in wheelchairs, and this entrance shall have access to the elevator in a multistory building.

E. *Elevators or Ramps for Multiple Story Buildings*

1. An elevator or ramp shall be provided in all multiple story buildings (two or more floors).

2. An elevator or ramp shall be provided in all adjoining multiple story additions except where an existing elevator or ramp adequately serves the entire structure.

3. Wherever an elevator is provided it shall be accessible to, and usable by, the physically disabled on the level that they use to enter the building.

4. Elevator cabs shall be large enough to enable a wheelchair to turn.

F. *Doors and Doorways*

1. Doors shall have a clear opening of no less than thirty-two inches and preferably thirty-six inches when open and shall be operable by a single effort. Automatic doors with hold-open feature are recommended for at least one entrance to the building. Interior doors equipped with closers should have hold-open feature.

2. The floor on the inside and outside of each doorway shall be level for a distance of five feet from the door in the direction the door swings and shall extend one foot beyond each side of the door.

3. Sharp inclines and abrupt changes in level shall be avoided at doorsills. As much as possible, thresholds shall be flush with the floor.

G. *Stairs and Handrails*

1. Steps shall, wherever possible, and in conformation with existing step formulas, have risers that do not exceed seven inches.

2. Steps in stairs shall have rounded "nosings" and no protruding nosings or abrupt change of surface from face or riser to tread.

3. Stairs shall have closed handrails on each side at least thirty-two inches high as measured from the tread at the face of the riser. At least one handrail shall extend eighteen inches beyond the top step and beyond the bottom step. Care shall be taken that the extension of the handrails is not in itself a hazard. The extension may be made on the side of a continuing wall.

H. *Toilet Rooms and Facilities*

1. At least one toilet room for each sex and for each floor shall have space to allow for traffic of individuals in wheelchairs.

2. One toilet room for each sex and for each floor shall have at least one toilet stall that is thirty-six inches wide and fifty-six inches deep, with a door (where doors are used) that is thirty-two inches wide and swings out and with handrails on each side which are thirty-three inches above the floor and parallel to the floor. Where no doors are used toilet stalls may be less than fifty-six inches deep, but not less than forty-eight inches to allow for installation of handrails.

I. *Water Fountains*

1. An appropriate number of water fountains or water dispensings means shall be accessible to, and usable by the physically disabled.

2. Conventional floor-mounted water coolers are satisfactory provided a small fountain is mounted on the side of the cooler thirty inches above the floor.

3. Wall-mounted, hand-operated fountains of the latest design can serve the able-bodied and the physically diabled equally well when the fountain is mounted with the basin thirty-six inches from the floor.

J. *Floors*

1. All non-level floor area including ramps and stair treads shall have nonslip surfaces.

2. Floors on a given story should be of a common level, wherever practicable, unless connected by proper ramps.

APPENDIX B
SHOP PLANNING CHECK LIST

Purpose

Know community to be served.	Yes	No
Facilities planned for specific level.	Yes	No
Purpose of the facility clearly stated.	Yes	No
All provisions made to meet curriculum.	Yes	No
Monies available to plan desired shop.	Yes	No
Facilities adapted to intended purposes.	Yes	No

General Laboratory Arrangement

Laboratories planned for future expansion.	Yes	No
Laboratories designed so they can be made smaller or larger.	Yes	No
Laboratories are not isolated from main educational plant.	Yes	No
Cluster type laboratories connected by covered walk passages.	Yes	No
Partitions constructed so they can be easily moved.	Yes	No
Laboratories are on the ground floor.	Yes	No
Type and height of ceilings are specified.	Yes	No
Laboratories are acoustically treated for auditory comfort.	Yes	No
Type of interior walls are specified.	Yes	No
Type of flooring is specified.	Yes	No
Laboratories are accessible for evening class use.	Yes	No
Noisy laboratories do not disturb other school activities.	Yes	No
Doors designed so the largest piece of equipment can be moved in and out of the laboratory.	Yes	No
Open spaces are provided near entrances and exits to eliminate congestion.	Yes	No
Spacing between benches, machinery, and equipment is sufficient for safety and free passage, preferably 4 ft., no less than 3 ft.	Yes	No
A clear space of 4 to 6 feet is provided in front of tool panels.	Yes	No
There are no obstructions which would prevent the instructor from looking over the entire open laboratory from any point in it.	Yes	No
An open assembly area is planned in laboratories requiring space for assembly of projects.	Yes	No
Laboratories are arranged by units with related processes grouped.	Yes	No
Most-used items are centrally located.	Yes	No
Color dynamics will be used in laboratories.	Yes	No
Shop equipment & furniture planned to be finished in a light color.	Yes	No
Working surfaces are not higher than elbow height.	Yes	No
Temperature for laboratories is 68 degrees measured 60 inches above the floor.	Yes	No
Temperature in classroom is 70 degrees measured 30 inches above the floor.	Yes	No
Spray booths in all finishing areas.	Yes	No
Finish room is dustproof and has an independent exhaust system.	Yes	No

Hand Tools and Storage

Tool panels are placed where the tools will be used most.	Yes	No
Tool panels are placed along natural routes of travel, for efficiency and safety.	Yes	No

Tool panels are not placed near the exit of the laboratory.	Yes	No
Tool panels are well lighted.	Yes	No
Tools will be stored in well-designed tool panels.	Yes	No
Tool panels are of a height and depth so the average student will be able to remove and replace any tool.	Yes	No
Tool panels designed for easy maintenance.	Yes	No
Related tools are placed together on panels.	Yes	No
Tool panels are designed to be easily checked for missing tools.	Yes	No
Tools for each laboratory are color coded with different colors.	Yes	No
The position of tools are outlined to ease in replacing.	Yes	No
Hand tools hung on tool panels are not easy to knock off their hangers.	Yes	No
Heavy tools are stored near the bottom of the tool panel.	Yes	No
Sharp tools are stored below eye level.	Yes	No
Sharp edges of tools hung on panels are protected to prevent injury.	Yes	No

Room Safety

Rooms well lighted.	Yes	No
Maximum fire and panic regulations.	Yes	No
Fire extinguishers located where needed.	Yes	No
Fire-alarm sounding in the shop.	Yes	No
Fire-alarm systems as part of the main system.	Yes	No
Clear traffic lanes (no projections).	Yes	No
Operational lanes marked clearly.	Yes	No
Exit lights above exterior doors.	Yes	No
Nonskid floors.	Yes	No
Excellent construction of storage racks.	Yes	No
Accessible center control electrical switch panel.	Yes	No
Utilities can be shut off where they enter the shop.	Yes	No
Laboratories supplied with adequate electrical wiring.	Yes	No
All electrical materials and workmanship approved by the National Board of Fire Underwriters.	Yes	No
Stairways and ladders protected.	Yes	No
Safety cans available for disposal of oily rags.	Yes	No
Paint and other combustible materials stored in metal cabinets.	Yes	No

Equipment

Proper size of power equipment has been ordered.	Yes	No
An adequate number of machines are provided for the size of classes for which the facility is designed.	Yes	No
Equipment is in excellent working order.	Yes	No
There is a replacement schedule for the equipment.	Yes	No
The equipment is color schemed.	Yes	No
Accessory panels are located near equipment.	Yes	No
Equipment for roughing stock is placed near the storage rooms.	Yes	No
Related equipment are grouped together.	Yes	No
All equipment except for the portable type is fastened securely to the floor, bench, or other stable foundation.	Yes	No
Equipment that creates vibration is cushioned with rubber or felt mountings.	Yes	No
Equipment is mounted to allow toe space and easy cleaning.	Yes	No

Equipment is not mounted on columns or against pipes if they will transmit noise to other parts of the building.	Yes	No

School Shop Space

	Sq. Ft. per pupil	Maximum number of students	Total Area		
Minimum	75	24	1800	Yes	No
Adequate	100	24	2400	Yes	No
Desirable	125	24	3000	Yes	No

Minimum ratio of the width of the shop to the length is 2:3.	Yes	No
The minimum height of the shop ceiling should be 12 feet.	Yes	No

Material and Supply Storage

Racks, shelving, drawers, and cabinets are provided in the storage rooms and near tool panels.	Yes	No
Storage rooms are located to ease unloading and storage of supplies as well as convenience in issuing supplies.	Yes	No
Every laboratory has its own storage area.	Yes	No
Special racks and shelving is provided for lumber and bar steel.	Yes	No
Places are provided for waste storage & containers.	Yes	No
Separate storage rooms are provided for extensive use by adult evening classes.	Yes	No

Project Storage

Satisfactory size for student lockers is 18 x 18 x 18".	Yes	No
The locker area is located so it can be supervised by the instructor.	Yes	No
Lockers are available for adult evening classes.	Yes	No
Storage spaces are provided for large project storage.	Yes	No

Instructor's Facilities

Instructor's area is located near the entrance of the laboratory.	Yes	No
The instructor's office has a desk, chairs, and file cabinet.	Yes	No
The instructor's office is enclosed by clear glass windows.	Yes	No
The instructor is provided with a wardrobe locker.	Yes	No
Telephone.	Yes	No

Utilities

Toilet facilities located in or near the laboratories.	Yes	No
Compressed air outlets on the wall in laboratories where it is needed.	Yes	No
Water for hand washing and/or quenching.	Yes	No
Gas services in appropriate places for furnaces, forges, and soldering equipment.	Yes	No

Teaching Aids and Storage

Visual-aid area located in the planning center. Yes No
Laboratory or planning area can be darkened for visual-aids. Yes No
A built-in or wall hung screen installed in laboratory or planning area. Yes No
Electrical outlets conveniently located for visual-aids. Yes No

Bulletin Boards and Chalkboards

Bulletin board placed in the planning area and entrance to the laboratory. Yes No
Chalkboard in the planning area and laboratory. Yes No

Planning Area or Classroom

Planning area located near the laboratory. Yes No
Display area located near the entrance. Yes No

Electrical

Separate circuits for each machine. Yes No
Circuit breakers for overload protection on power circuits. Yes No
Outlets, 110 and 220 volt, installed on the walls at convenient locations and intervals. Yes No
Safety buttons for equipment installed on the walls at intervals of 15 to 20 feet. Yes No
Outside outlets, both 110 and 220 volt. Yes No
Provisions made for closed-circuit T.V. Yes No
Spare power circuits, one for every 4 active circuits. Yes No
Raceway or buss type electrical power system overhead. Yes No

Lighting

Lighting in laboratory and classroom produces 110-200 foot candles of light on the work surface. Yes No
Lighting produces a uniform distribution of shadow-free and glare-free illumination. Yes No
Special darkroom lights are installed. Yes No

Health Precautions

First-aid kit located in the laboratory. Yes No
Fire extinguishers located near points of danger and labeled. Yes No
All electrical switches enclosed. Yes No
Welding helmets, safety glasses, and shields provided. Yes No
Sterilizing cabinets for face shields and safety glasses. Yes No

Heating, Cooling and Ventilating

Thermostat located in the laboratory to control temperature. Yes No

Exhaust system provided for welding, forging, and the hot metals.	Yes	No
Dust collection system provided for grinders, planers, jointers, saws, sanders, etc.	Yes	No
Ventilating system provided for finish room.	Yes	No
Adequate and quiet heating unit provided.	Yes	No
Air conditioning provided for or provisions made for later installation.	Yes	No

APPENDIX C
CROSS REFERENCE CHART

TOPICS / **PUBLICATIONS**	*A.V.A. for Facility Dev. Spes. Voc. Practical Arts*	*A Guide for Planning School Facilities for I.A.—State of N. J.*	*School Shop Text Development—Rockwell*	*Principles of Shop Planning—State of Illinois*	*Pamphlet C-7 I.A. Manual for Secondary School Building*	*How to Plan a School Workshop—Delta*	*A guide for I.A. in Ohio Schools*	*Freeman Supply—Toledo shop Planning Packet*	*Standards for Auto Services A.M.A.*	*Modern School Shop Planning—Prakken*	*I.A.V.E. March, 1966 Vol. 55, No. 3*	*I.A.V.E. March 1967 Vol. 56, No. 3*	*A.C.I.A.T.E. Planning I.A. Facilities 8th Yearbook, 1959*	*Guide for Planning and Equipping I.A. Shops in California*	*Industrial Education Facility Bulletin—Michigan*
Ed. Specifications	X	X	X	X		X	X	X	X	X	X	X	X	X	X
Ascertaining Community Needs	X	X	X					X					X		
Use of Service Consultant	X							X	X				X		
Teaching Stations	X	X			X				X						
Architectural and Engineering Practice	X		X										X		
Planning Relationship between I.A. and Voc. Ed.	X									X					
Student Group Characteristics	X							X			X				
Local School Philosophy of I.A.	X	X								X			X		
Selection Equipment	X	X	X	X		X	X	X	X	X	X	X	X		X
Projection Enrollment				X						X					
Space Requirements	X	X		X			X	X		X			X	X	X
Evaluation Check List		X								X		X	X		
Safety		X	X	X			X	X	X	X	X			X	X
Elementary I.A.		X					X			X	X		X		
Jr. High I.A.	X	X	X			X	X			X	X		X		
Sr. High I.A.	X	X	X			X	X		X	X	X		X		
Purchasing			X				X	X		X			X		
Bibliography	X	X	X	X		X	X	X		X			X		
Legal Considerations													X		
Planning Concepts	X	X	X	X				X	X	X	X	X	X	X	X
Scale Layout Developments			X			X		X	X	X	X	X	X	X	
Equipment Source Check List		X	X												
Determining Number of Laboratories		X		X	X										
Laboratory Organization	X				X		X			X					
Aids and Planning Format			X		X			X							
New Round Design										X	X	X			

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APPENDIX D
BIBLIOGRAPHY

Books

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American Standards Association. *Making Buildings and Facilities Accessible to, and Usable by, the Physical Handicapped.* ASA Project A117.10 1951, 10 East 40th Street, New York 16, N.Y. p. 3.

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Wagner, Willis H. *Planning Industrial Arts Shops.* Department of Industrial *Arts* & Technology. State College of Iowa, Cedar Falls, Iowa. 32 pp.

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Williams, William A. Ph.D., Professor of Industrial Education. *An Accident Prevention Program for School Shops and Laboratories.* Department of Vocational Education. The Pennsylvania State University published by National Safety Council — 425 North Michigan Avenue, Chicago, Illinois 60611. $6.50 (20% discount to schools). 250 pp.